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OBSERVATIONS ON THE COCCIDAE OF FORMOSA

PART I

BY

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OBSERVATIONS ON THE COCCIDAE OF FORMOSA.—1.

BY

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Introduction.

The family Coccidae[※] is essentially a tropical or subtropical group of insects and is well represented in the fauna of Formosa. These insects are especially abundant, both in species and in individuals, in the lower areas of our island, where the mojority of them attack various plants of economic value, at times causing serious damage to them.

The insects of this family in Formosa have been studied by Chamberlin, Ferris, Kuwana, Maskell, Shiraki, Takahashi, and others, but there still remains a great deal to be done. In this contribution will be presented the data accumulated during the past few years. Previous knowledge of the Formosan Non-Diaspine Coccidae is summed up in my papers published in the Philippine Journal of Science (vol. 36, pp. 327-348) and in the Transactions of the Natural History Society of Formosa (vol. 18, pp. 253-261), in which were listed 55 species and 2 varieties in all. In the present paper are enumerated 113 species and 2 varieties, a small proportion of which (7 species) are described as new to science and a larger proportion (20 species, excluding the new forms, and a variety) are here recorded for the first time from Formosa. But it must be stated here that the plants hitherto examined are for the most part cultivated ones and further collecting on wild plants, especially in the mountainous districts, will doubtless reveal more new and interesting forms. It is probable that over 150 species of these insects exist in our island and no attempt has been made here to formulate keys.

The coccid fauna of Formosa includes many imported species, but some appear to be indigenous to the island, showing a close affinity of the coccid fauna of the island to that of India or Ceylon.

※ The family Coccidae is divided by recent specialists into several families, but I shall here treat it as one conventional family.

All the figures accompanying this paper were made by me. All the type specimens will be preserved in the entomological laboratory of the Department of Agriculture, Research Institute, Taihoku, Formosa.

I express here my hearty thanks to Mr. E. E. Green, Dr. I. Kuwana, Dr. H. Morrison, Prof. T. Shiraki and others for their kind assistance in various ways and to Prof. C. R Kellogg for his kindness in correcting errors in English in the manuscript of a part of this paper. I am also indebted to Messrs. T. Ishii and C. Teranishi who have kindly identified some Hymenoptera.

Economic aspects of the Formosan Coccidae.

The family includes a large proportion of injurious insects, and all the fruit and ornamental trees in Formosa are subject to attacks of one or more species of coccid. Out in the fields I have never found a single Citrus tree in our island entirely free from these insects, each tree usually harboring several species.

Among the insects of this family in Formosa the most important from an economic standpoint are *Icerya purchasi* Mask, *I. aegyptiaca* Dougl., *Pseudococcus citri* Risso, *P. lilacinus* Ckll., *P. filamentosus* Ckll., *Trionymus sacchari* Ckll., *Ferrisia virgata* Ckll., *Pulvinaria psidii* Mask., *Coccus viridis* Green, *Saissetia hemisphaerica* Targ., *S. formicarii* Green, *Aulacaspis yabunikkei* Kuw., *Chrysomphalus aonidum* L. and others. They are abundant in our island, attacking various plants of economic importance and sometimes causing serious damage.

Saissetia oleae Bern. destructive in Europe and North America is very scarce in Formosa, showing no indication of becoming a menace to our cultivated plants. *Coroplastes rubens* Mask., which is abundant on Citrus in Honshu, is very few, especially on Citrus, in our island; and *Ceroplastes ceriferus* And., *C. floridensis* Comst., *Phenacoccus hirsutus* Green, *Chrysomphalus dictyospermi* Morg., etc., are very injurious in Japan proper or other countries, while they are of no economic importance, occurring in restricted numbers, in Formosa. In Honshu *Chrysomphalus aurantii* Mask. seems to be more common on Citrus than *C. aonidum* L., whereas in Formosa the latter pest is much more abundant than the former.

Aspidiotus perniciosus Comst., *Prontaspis yanonensis* Kuw., and several other preeminent coccid pests in Japan proper, China, and other adjacent countries are fortunately not found in our island.

Citrus, the most important among the Formosan fruit trees, is attacked by 28 species of these insects as shown in the food-plant catalogue in this report,

among which the most important are *Chrysomphalus aonidum* L., *Parlatoria zizyphus* Lucas, *Lepidosaphes becki* Newm., *L. gloveri* Pack., and *Pulvinaria polygonata* Ckll., the first mentioned two species being especially abundant. Pineapple is infested by only *Pseudococcus brevipes* Ckll., and banana is almost free from these pests, occasionally being attacked by a few numbers of *Saissetia nigra* Nietn. and *Chrysomphalus aonidum* L. Sugar cane which occupys the most preeminent position among the crops in Formosa is now known to be fed upon by 6 species of coccids, of which *Trionymus sacchari* Ckll., *T. diminutus* Leon., *Lecanopsis sacchari* Takah., and *Mizococcus sacchari* Takah. are more important; but rice plant has no coccid pests in our island. Tea plant is infested by 13 species, among which *Pinnaspis theae* Mask., *Eriochiton theae* Green, *Saissetia hemisphaerica* Targ., and *Tachardina theae* Green et Mann seem to be more important. Various ornamental trees are injured by *Icerya aegyptiaca* Dougl., *Pseudococcus citri* Risso, *P. filamentosus* Ckll., *P. lilacinus* Ckll., *Ferrisia virgata* Ckll, *Saissetia hemisphaerica* Targ., *S. formicarii* Green, *Pulvinaria psidii* Mask, and many other species.

Most of these troublesome pests have been previously described from other countries, showing a wide distribution, and have evidently been introduced on cultivated plants, which forces upon us the conviction that we must place the work of plant inspection as one of the most important of the preventive measures. There are a number of species which are very injurious pests in Japan proper, China, and other countries, but which are not yet found in Formosa and, if introduced, might prove to be dangerous pests here. They may easily be transported with plants and the greatest care on the part of plant inspectors is necessary to prevent their spread to our island.

The lac insect, *Laccifer lacca* Kerr, and the white-wax scale, *Ericerus pela* Chev., are not found in Formosa, but one of the useful coccids, *Laccifer greeni* Chamb., is not uncommon at Kagi, the manufacturing of lac from which seems to be more or less promising.

Food plants of the Formosan Coccidae.

A large majority of these insects are decidedly polyphagous, infesting plants belonging to widely separated groups in the system of classification. For example, *Saissetia hemisphaerica* Targ. and *Chrysomphalus aonidum* L. feed not only upon a very wide range of broad-leaved plants, but also on the Cycadaceae

and sometimes on the Coniferae in our island. But a preferential host selection occurs to some extent among these insects. The species on the Gramineae are not found on other plants and *vice versa*. *Pseudococcus lilacinus* Ckll. and *Ferrisia virgata* Ckll., inhabiting various broad-leaved plants, are only occasionally found on Citrus and have not been detected on the Coniferae, while, as far as I have observed, *Formicococcus cinnamomi* Takah. is confined to the camphor tree, *Pilococcus miscanthi* Takah. to *Miscanthus*, and *Asterolecanium corallinus* Takah. to *Sideroxylon ferrugineum*.

It is a very remarkable fact that the introduced species are more polyphagous, while the species which seem to be indigenous to Formosa are more restricted in their hosts. It is also noticeable that the trees which remain green throughout the year are attacked by more species of these insects than are those which shed all their leaves in any one season, and the host plants of the coccids of Formosa belong for the greater part to the former group, the evergreens. The ever-green trees, *Citrus*, *Ficus retusa*, *Gardenia*, *Mangifera*, *Thea*, etc., are infested by many species, while *Ficus wightiana*, *Sapium sebiferum*, *Prunus*, *Salix*, etc., which lose all the leaves in winter or some season, are infested by only a few species. The evergreen trees are doubtless more suitable to the life of this group of insects, constantly supplying them breeding places on the leaves and not killing them by shedding the leaves all at once.

Eucalymnatus tessellatus Signt., *Paralecanium expansum* Green, and *Chrysomphalus aonidum* L. are polyphagous, but most of the leaves attacked by them, although found in different taxonomic groups, have in common the following physical characters:

(1) The leaves are smooth, shining, and lacking hairs.

(2) The leaves are hard.

Nearly all the host plants of the Formosan Coccidae are the higher plants, although a fungus and a moss are now known to be attacked by *Newsteadia* sp. in our island.

About 225 species of plants arranged in some 160 genera belonging to 61 families have been observed to be attacked by the Formosan Coccidae in the island alone. In the following list the names of all these hosts are arranged alphabetically.

Food plant catalogue of the Formosan Coccidae.

Acacia confusa (Leguminosae)
- Coccus elongatus Signt.
- Icerya purchasi Mask.
- Pseudococcus citri Risso.
- P. lilacinus Ckll.

Acalypha kotoensis (Euphorbiaceae)
- Chionaspis vitis Green.

Acalypha sp.
- Ferrisia virgata Ckll.

Acer sp.? (Sapindaceae)
- Parlatoria crotonis Dougl.

Achros sapota (Sapotaceae)
- Coccus viridis Green.

Adiantum concatum (Polypodiaceae)
- Saissetia hemisphaerica Targ.

Adiantum sp.
- Saissetia hemisphaerica Targ.

Adinandra formosana (Ternstroemiaceae)
- Anomalococcus sp.

Aegle marmelos (Rutaceae)
- Coccus viridis Green.

Aegle sepiaria
- Ceroplastes floridensis Comst.
- Saissetia formicarii Green.

Agave rigida (Amaryllideae)
- Coccus hesperidum L.
- Saissetia hemisphaerica Targ.

Agave sp.
- Coccus hesperidum L.

Agina globosa (Caryophulaceae)
- Saissetia hemisphaerica Targ.

Aglaia formosana (Meliaceae)
- Eucalymnatus tessellatus Signt.

Aglaia odorata

Saissetia formicarii Green.

Allophylus rheedi (Sapindaceae)

Ferrisia virgata Ckll.

Ananas sativus (Bromeliaceae)

Pseudococcus brevipes Ckll.

Anona muricata (Anonaceae)

Icerya aegyptiaca Dougl.

Anona reticulata

Pseudococcus lilacinus Ckll.

Anona squamosa

Coccus elongatus Sigt.

Ferrisia virgata Ckll.

Anona sp.

Coccus elongatus Signt.

Siassetia hemisphaerica Targ.

Ardisia crispa (Myrsineae)

Saissetia hemisphaerica Targ.

Ardisia quinquegona

Saissetia hemisphaerica Targ.

S. nigra Nietn.

Ardisia sieboldii

Chrysomphalus aurantii Mask.

Lepidosaphes kamakurensis Kuw.

Saissetia formicarii Green.

Tachardina theae Green et Mann.

Areca catechu (Palmae)

Chrysomphalus aonidum L.

Coccus elongatus Signt.

Icerya seychellarum Westw.

Pseudococcus adonidum L.

Saissetia nigra Nietn.

Areca oleracea

Coccus hesperidum L.

Pseudococcus lilacinus Ckll.

Saissetia formicarii Green.

Artabotrys odoratissimus (Anonaceae)

Chrysomphalus aonidum L.

Artemisia capillaris (Compositae)

Ceroplastes ceriferus And.

Icerya purchasi Mask.

Saissetia nigra Nietn.

Artocarpus incisa (Urticaceae)

Icerya aegyptiaca Dougl.

Pseudococcus citri Risso.

P. lilacinus Ckll.

Artocarpus integrifolia

Coccus acutissimus Green.

Ferrisia virgata Ckll.

Icerya aegyptiaca Dougl.

Pseudaonidia trilobitiformis Green.

Pseudococcus citri Risso.

P. lilacinus Ckll.

Pulvinaria psidii Mask.

Saissetia formicarii Green.

Artocarpus sp.

Ceroplastes floridensis Comst.

Aspidistra lurida (Liliaceae)

Pinnaspis aspidistrae Signt.

Asplenium nidus (Polypodiaceae)

Pinnaspis aspidistrae Signt.

Averrhoa carambola (Geraniaceae)

Laccifer greeni Chamb.

Bambusa stenostachya (Gramineae)

Antonina bambusae Mask.

Asterolecanium bambusae Boisd.

Odonaspis penicillata Green.

O. secreta Green.

Trionymus pulverarius Newst. var. bambusae Green.

Bambusa sp.

Antonina bambusae Mask.

A. crawi Ckll.

Asterolecanium bambusae Boisd.

A. tuberculatum Takah.

Chionaspis elongata Green.

Ripersia cellulosa Hall.

Bauhinia alba (Leguminosae)

Coccus hesperidum L.

Bauhinia purparea

Ferrisia virgata Ckll.

Pseudococcus lilacinus Ckll.

Bischoffia javanica (Euphorbiaceae)

Saissetia formicarii Green.

S. hemisphaerica Targ.

S. nigra Nietn.

Bladhia morrisonensis (Myrsineae)

Puto mangiferae Green.

Saissetia hemisphaerica Targ.

Blumea balsamifera (Compositae)

Pseudococcus citri Risso.

Bombax malabaricum (Malvaceae)

Ferrisia virgata Ckll.

Broussonetia papyrifera (Urticaceae)

Pseudococcus filamentous Ckll.

Bryophyllum calycinum (Crassulaceae)

Chrysomphalus rossi Mask.

Pseudococcus citri Risso.

Buxus japonicus (Euphorbiaceae)

Chrysomphalus aonidum L.

Calathea tubispatha (Orchideae)

Pseudococcus citri Risso.

Calathea sp.

Saissetia hemisphaerica Targ.

Calliandra haematocephala (Leguminosae)

Coccus elongatus Signt. .

Ferrisia virgata Ckll.
Lacciferi greeni Chamb.
Callicarpa formosana (Verbenaceae)
Coccus hesperidum L.
Pseudococcus lilacinus Ckll.
Saissetia formicarii Green.
Calophyllum inophyllum (Guttiferae)
Ceroplastes floridensis Comst.
C. rubens Mask.
Chrysomphalus aonidum L.
C. rossi Mask.
Coccus elongatus Signt.
C. hesperidum L.
Encalymnatus tessellatus Signt.
Pseudaonidia trilobitiformis Green.
Pseudococcus adonidum L.
Saissetia nigra Nietn.
S. oleae Bern.
Canna indica (Scitamineae)
Saissetia nigra Nietn.
Carica papaya (Passifloreae)
Aspidiotus destructor Signt.
Coccus hesperidum L.
Carissa carandas (Apocynaceae)
Ceroplastes floridensis Comst.
Chrysomphalus aonidum L.
Coccus viridis Green.
Lepidosaphes gloveri Pack.
Pseudococcus filamentosus Ckll.
Saissetia hemisphaerica Targ.
Carludovica palmata (Palmae)
Pseudococcus citri Risso.
Casuarina equisetifolia (Casuarineae)
Coccus elongatus Signt.
Ferrisia virgata Ckll.

Icerya purchasi Mask.

Celtis sinensis (Urticaceae)

Fiorinia chinensis Ferris.

Celtis sp.

Icerya aegyptiaca Dougl.

Chrysophyllum cainito (Sapotaceae)

Icerya seychellarum Westw.

Pulvinaria psidii Mask.

Saissetia hemisphaerica Targ.

S. nigra Nietn.

Cinchona sp. (Rubiaceae)

Saissetia hemisphaerica Targ.

Cinnamomum camphora (Lauraceae)

Aulacaspis yabunikkei Kuw.

Ceroplastes rubens Mask.

Chrysomphalus aonidum L.

Formicococcus cinnamomi Takah.

Saissetia formicarii Green.

Cinnamomum camphora nominale.

Saissetia formicarii Green.

Cinnamomum ceylanicum.

Anomalococcus sp.

Eucalymnatus tessellatus Signt.

Neoplatylecanium cinnamomi Takah.

Saissetia formicarii Green.

Citrus spp. (Rutaceae)

Ceroplastes ceriferus And.

C. floridensis Comst.

C. rubens Mask.

Chrysomphalus aonidum L.

C. aurantii Mask.

C. dictyospermi Morgan.

Coccus elongatus Signt.

C. hesperidum L.

C. viridis Green.

Drosicha sp.
Ferrisia virgata Ckll.
Fiorinia theae Green.
Icerya purchasi Mask.
I. seychellarum Westw.
Laccifer sp.
Lepidosaphes becki Newm.
L. gloveri Pack.
Parlatoria pergandei Comst.
P. proteus Curtis.
P. zizyphus Lucas.
Pseudaonidia trilobitiformis Green.
Pseudococcus adonidum L.
P. citri Risso.
P. lilacinus Ckll.
Pulvinaria polygonata Ckll.
P. psidii Mask.
Saissetia hemisphaerica Targ.
S. nigra Nietn.

Clausena lunulata (Rutaceae)
Coccus viridis Green.

Clausena wampi
Pseudococcus citri Risso.

Clerodendron inerme (Verbenaceae)
Aspidiotus excisus Green.

Cleyera ochnacea (Ternstroemiaceae)
Chrysomphalus aonidum L.
Pinnaspis unilola Kuw.

Cocos nucifera (Palmae)
Aspidiotus lataniae Signt.
Chrysomphalus aonidum L.
Coccus hesperidum L.
Eucalymnatus tessellatus Signt.

Codiaeum variegatum (Euphorbiaceae)
Coccus elongatus Signt.

Ferrisia virgata Ckll.
Icerya aegyptiaca Dougl.
Pseudococcus lilacinus Ckll.
Saissetia nigra Nietn.

Coffea arabica (Rubiaceae)
Coccus viridis Green.
Ferrisia virgata Ckll.
Pseudococcus filamentosus Ckll.
Pulvinaria psidii Mask.
Saissetia hemisphaerica Targ.

Cucurbita moschata (Cucurbitaceae)
Saissetia hemisphaerica Targ.

Cunninghamia lanceolata (Coniferae)
Saissetia hemisphaerica Targ.

Cycas revoluta (Cycadaceae)
Aspidiotus lataniae Signt.
Chrysomphalus aonidum L.
C. dictyospermi Morg.
Lepidosaphes cymbidicola Kuw.
Saissetia hemisphaerica Targ.

Cymbidium sinense (Orchideae)
Aspidiotus lataniae Signt.
Parlatoria pergandei Comst.
P. proteus Curtis.

Dendrobium moschatum (Orchideae)
Parlatoria crotonis Dougl.

Dendrocalamus latiflorus (Gramineae)
Asterolecanium bambusae Boisd.
Odonaspis penicillata Green.

Derris laxiflora (Leguminosae)
Coccus elongatus Signt.

Diospyros discolor (Ebenaceae)
Ceroplastes floridensis Comst.
Saissetia formicarii Green.
S. hemisphaerica Targ.

Diospyros kaki

Saissetia formicarii Green.

Ehretia sp. (Boragineae)

Coccus hesperidum L.

Elaeagnus glabra (Elaeagnaceae)

Chionaspis vitis Green.

Elaeagnus kotoensis

Chionaspis vitis Green.

Elaeagnus thunbergii

Chionaspis vitis Green.

Elephantopus mollis (Compositae)

Aspidiotus excisus Green.

Eriobotrya japonica (Rosaceae)

Ceroplastes floridensis Comst.

Coccus hesperidum L.

Icerya seychellarum Westw.

Eriodendron anfractuosum (Malvaceae)

Saissetia formicarii Green.

Erythrina sp. (Leguminosae)

Lepidosaphes tubulorum Ferris.

Pseudococcus lilacinus Ckll.

Erythroxylon coca spruceanum (Linnaceae)

Coccus elongatus Signt.

Eucalyptus sp. (Myrtaceae)

Fiorinia fioriniae Targ.

Saissetia formicarii Green.

Eugenia jambos (Myrtaceae)

Ceroplastes rubens Mask.

Coccus acutissimus Green.

Pseudococcus lilacinus Ckll.

Eugenia javanica

Ferrisia virgata Ckll.

Icerya seychellarum Westw.

Pseudococcus filamentosus Ckll.

P. lilacinus Ckll.

Saissetia formicarii Green.

S. nigra Nietn.

Eugenia unifolia

Saissetia hemisphaerica Targ.

Euphorbia pulcherrima (Euphorbiaceae)

Ferrisia virgata Ckll.

Euphoria longana (Sapindaceae)

Ceroplastes rubens Mask.

Coccus acutissimus Green.

C. hesperidum L.

Eucalymnatus tessellatus Signt.

Fiorinia nepheli Mask.

Laccifer greeni Chamb.

Pulvinaria psidii Mask.

Saissetia oleae Bern.

Eurya japonica (Ternstroemiaceae)

Pinnaspis aspidistrae Signt.

P. uniloba Kuw.

Evodia roxburghiana (Rutaceae)

Chrysomphalus aonidum L.

Evodia triphylla

Saissetia formicarii Green.

Ficus carica (Urticaceae)

Saissetia nigra Nietn.

Ficus elastica

Eucalymnatus tessellatus Signt.

Pseudaonidia trilobitiformis Green.

Saissetia nigra Nietn.

Ficus gibosa.

Saissetia nigra Nietn.

Ficus leucantatoma

Saissetia formicarii Green.

Ficus pumila.

Fiorinia chinensis Ferris.

Ficus retusa

Chrysomphalus aonidum L.
Ceroc ccus ficoides Green.
Ceroplastes ceriferus And.
Ceroplastodes chiton Green.
Coccus elongatus Signt.
Drosicha sp.
Ferrisia virgata Ckll.
Paralecanium expansum Green.
Pseudaonidia trilobitiformis Green.
Pseudococcus adonidum L.
Saissetia nigra Nietn.
Tachardina theae Green et Mann.

Ficus vasculosa
Saissetia formicarii Green.

Ficus wightiana.
Icerya aegyptiaca Dougl.
I. seychellarum Westw.
Laccifer greeni Chamb.
Saissetia formicarii Green.
S. hemisphaerica Targ.
S. nigra Nietn.

Ficus sp.
Aspidiotus destructor Signt.
Fiorinia sapromae Green.
Pseudaonidia trilobitiformis Green.

Ficus sp.
Saissetia formicarii Green.
S. nigra Nietn.

Garcinia spicata (Guttiferae)
Ceroplastes rubens Mask.
Chrysomphalus aonidum L.
Saissetia formicarii Green.
S. hemisphaerica Targ.
Vinsonia stellifera Green.

Gardenia florida (Rubiaceae)

Cerococcus ficoides Green.
Ceroplastes floridensis Comst
Coccus acutissimus Green.
C. hesperidum L.
C. viridis Green.
Pseudococcus adonidum L.
P. filamentosus Ckll.
P. lilacinus Ckll.
Pulvinaria psidii Mask.
Saissetia formicarii Green.
S. hemisphaerica Targ.
S. oleae Bern.

Genipa americana (Rubiaceae)
Coccus viridis Green.

Glochidion hypoleuca (Euphorbiaceae)
Anomalococcus sp.

Glochidion eryocarpum
Coccus hesperidum L.

Glochidion fortunei.
Anomalococcus sp.

Glochidion sp.
Anomalococcus sp.
Coccus hesperidum L.
Saissetia nigra Nietn.

Gordonia axillaris (Ternstroemiaceae)
Saissetia formicarii Green.

Gossypium herbaceum (Malvaceae)
Saissetia nigra Nietn.
S. oleae Bern.

Gramineae (a plant of the)
Chionaspis graminis Green var. divergens Green.
C. stanotophri Cooley.

Grevillea robusta (Proteaceae)
Saissetia formicarii Green.

Helicia cochinchinensis (Proteaceae)

Pseudococcus adonidum L.

Heptapleurum octophyllum (Araliaceae)

Chrysomphalus aurantii Mask.

Lepidosaphes kamakurensis Kuw.

Saissetia formicarii Green.

Heritiera littoralis (Sterculiaceae)

Eucalymnatus tessellatus Signt.

Laccifer greeni Chamb.

Pseudococcus lilacinus Ckll.

Heterosmilax japonica (Liliaceae)

Lepidosaphes kamakurensis Kuw.

Hibiscus rosasinensis (Malvaceae)

Aspidiotus lataniae Signt.

Coccus elongatus Signt.

Phenacoccus hirsutus Green.

Inocarpus edulis (Leguminosae)

Ferrisia virgata Ckll.

Ixora chinensis (Rubiaceae)

Ceroplastes ceriferus And.

Coccus viridis Green.

Pseudococcus citri Risso.

Saissetia hemisphaerica Targ.

Kandelia rheedii (Rhizophoreae)

Chrysomphalus rossi Mask.

Lepidosaphes pallida Green.

Chionaspis vitis Green.

Kentia macarthurii (Palmae)

Saissetia formicarii Green.

Keteleeria davidiana (Coniferae)

Fiorinia japonica Kuw.

Lagerstroemia flos-reginae (Lythrarieae)

Saissetia formicarii Green.

Lagerstroemia indica

Saissetia hemisphaerica Targ.

Lespedeza sp. (Leguminosae)

Pseudococcus citri Risso.

Ligustrum japonicum (Oleaceae)

Chrysomphalus aonidum L.

Liquidambar formosana (Hamamelideae)

Laccifer greeni Chamb.

Lithocarpus sp. (Cupuliferae)

Lecaniodiaspis cremastogastri Takah.

Lithocarpus sp.

Saissetia formicarii Green.

Maba buxifolia (Ebenaceae)

Icerya seychellarum Westw.

Macaranga dipterocarpifolia (Euphorbiaceae)

Pseudococcus lilacinus Ckll.

Macaranga sp.

Pseudococcus lilacinus Ckll.

Machilus kusanoi (Laurineae)

Fiorinia fioriniae Targ.

Machilus sp.

Chrysomphalus aonidum L.

Pseudaonidia trilobitiformis Green.

Machilus sp.

Aulacaspis mangiferae Newst.

Ceroplastes floridensis Comst.

Eucalymnatus tessellatus Signt.

Icerya seychellarum Westw.

Laccifer greeni Chamb.

Paradecanium expansum Green.

Saissetia formicarii Green.

S. hemisphaerica Targ.

Tachardina theae Green et Mann.

Maesa sinensis (Myrsineae)

Ceroplastes floridensis Comst.

Magnolia sp. (Magnoliaceae)

Pseudococcus adonidum L.

Mahonia japonica (Berberideae)

Chrysomphalus aonidum L.

Mallotus japonicus (Euphorbiaceae)

Cerococcus ficoides Green.

Pseudococcus lilacinus Ckll.

Mallotus philippensis

Coccus hesperidum L.

Icerya aegyptiaca Dougl.

Chionaspis vitis Green.

Mallotus sp.

Pseudococcus lilacinus Ckll.

Mangifera indica (Anacardiaceae)

Aulacaspis mangiferae Newst.

Ceroplastes ceriferus And.

C. floridensis Comst.

C. rubens Mask.

Chrysomphalus rossi Mask.

Coccus hesperidum L.

C. mangiferae Green.

Eucalymnatus tessellatus Signt.

Icerya seychellarum Westw.

Laccifer greeni Chamb.

Pulvinaria psidii Mask.

P. taiwana Takah.

Saissetia formicarii Green.

S. hemisphaerica Targ.

Vinsonia stellifera Green.

Melastoma candidum (Melastomaceae)

Ceroplastes ceriferus And.

Michelia alba (Magnoliaceae)

Coccus hesperidum L.

Phenacaspis eugeniae Mask.

Saissetia formicarii Green.

Michelia compressa

Tachardina theae Green et Mann.

Michelia fuscata

Phenacaspis eugeniae Mask.
Pseudaonidia duplex Ckll.
Tachardina theae Green et Mann.

Michelia longifolia
Coccus acutissimus Green.
C. punctuliferus Green.
Tachardina theae Green et Mann.

Michelia sp.
Coccus acutissimus Green.
Saissetia formicarii Green.

Milletia nitida (Leguminosae)
Coccus elongatus Signt.
C. hesperidum L.

Miscanthus sinensis (Gramineae)
Aulacaspis wakayamensis Kuw.
Pilococcus miscanthi Takah.
Pygalataspis miscanthi Ferris.
Ripersia cellulosa Hall.
Trionymus latus Takah.

Miscanthus sp.
Aulacaspis wakayamensis Kuw.
Lecanopsis sacchari Takah.
Mizococcus sacchari Takah.
Pilococcus miscanthi Takah.
Pygalataspis miscanthi Ferris.
Ripersia cellulosa Hall.
Trionymus latus Takah.
T. sacchari Ckll.

Monstera deliciosa (Araliaceae)
Parlatoria proteus Curtis.

Morus acidosa (Urticaceae)
Pulvinaria thespesiae Green.

Morus alba
Aspidiotus lataniae Signt.
Ceroplastes ceriferus And.

Coccus elongatus Signt.
Diaspis pentagona Targ.
Icerya aegyptiaca Dougl.
I. seychellarum Westw.
Phenacoccus hirsutus Green.
Pseudococcus citri Risso.
Saissetia nigra Nietn.

Murraya exotica (Rutaceae)
Coccus bicruciatus Green.
Lepidosaphes becki Newm.
Pseudaonidia trilobitiformis Green.
Pulvinaria polygonata Ckll.

Musa sapientum (Scitamineae)
Chrysomphalus aonidum L.
S. nigra Nietn.

Musaenda luteola (Rubiaceae)
Pseudococcus filamentosus Ckll.

Musci (a species of)
Newsteadia sp.

Myrica rubra (Myricaceae)
Coccus elongatus Signt.
Paralecanium expansum Green.
Tachardina theae Green et Mann.

Myristica heterophylla (Myristiceae)
Ceroplastes rubens Mask.
Chrysomphalus aonidum L.
Saissetia formicarii Green.

Nephelium litchi (Sapindaceae)
Coccus elongatus Signt.
Fiorinia nepheli Mask.

Nerium odorum (Apocynaceae)
Asterolecanium pustulans Ckll.
Ferrisia virgata Ckll.
Pseudococcus filamentosus Ckll.
Saissetia oleae Bern.

Olea europea (Oleaceae)
Saissetia formicarii Green.
Orchideae (1 species of the)
Lepidosaphes cymbidicola Kuw.
Pinnaspis aspidistrae Signt.
Saissetia hemisphaerica Targ.
Osmanthus fragrans (Oleaceae)
Chrysomphalus aonidum L.
Coccus elongatus Signt.
Parlatoria pergandei Comst.
Pinnaspis uniloba Kuw.
Saissetia hemisphaerica Targ.
Palaquium formosanum (Sapotaceae)
Ceroplastes rubens Mask.
Chrysomphalus aonidum L.
Coccus mangiferae Green.
Eucalymnatus tessellatus Signt.
Icerya seychellarum Westw.
Laccifer greeni Chamb.
Saissetia formicarii Green.
Pandanus boninensis (Pandaneae)
Aspidiotus destructor Signt.
Pandanus odoratissimus
Chrysomphalus aonidum L.
Passiflora edulis (Passiflorae)
Pseudococcus citri Risso.
Persea gratissima (Laurineae)
Ceroplastes ceriferus And.
C. rubens Mask.
Drosicha contrahens Walk.
Icerya seychellarum Westw.
Ferrisis virgata Ckll.
Pseudococcus citri Risso.
Saissetia formicarii Green.
Pinus thunbergii (Coniferae)

Fiorinia japonica Kuw.

Pinus sp.

Chrysomphalus aonidum L.

Pirus sp. (Rosaceae)

Saissetia nigra Nietn.

Pithecolobium dulce (Leguminosae)

Coccus elongatus Signt.

Platanus orientalis (Platanaceae)

Laccifer greeni Chamb.

Plumeria acutifolia (Apocynaceae)

Coccus viridis Green.

Ferrisia virgata Ckll.

Saissetia hemisphaerica Targ.

S. nigra Nietn.

Podocarpus macrophylla (Coniferae)

Chrysomphalus aonidum L.

Fiorinia juniperi Leon.

Icerya seychellarum Westw.

Polygonum chinense (Polygonaceae)

Ceroplastes ceriferus And.

Polyolthia longifolia (Anonaceae)

Coccus elongatus Signt.

Polyporaceae (a species of the)

Newsteadia sp.

Pometia pinnata (Sapindaceae)

Ceroplastes ceriferus And.

Coccus elongatus Signt.

Poncirus trifoliata (Rutaceae)

Ceroplastes floridensis Comst.

Prunus communis (Rosaceae)

Diaspis pentagona Targ.

Pseudococcus adonidum L.

Prunus persica

Diaspis pentagona Targ.

Prunus pogonostyla

Diaspis pentagona Targ.

Prunus sp.

Diaspis pentagona Targ.

Saissetia formicarii Green.

Psidium guyava (Myrtaceae)

Ceroplastes floridensis Comst.

Coccus viridis Green.

Ferrisia virgata Ckll.

Icerya aegyptiaca Dougl.

I. seychellarum Westw.

Pseudococcus adonidum L.

P. citri Risso.

Pulvinaria psidii Mask.

Saissetia formicarii Green.

S. hemisphaerica Targ.

S. nigra Nietn.

Psychotria elliptica (Rubiaceae)

Ceroplastes floridensis Comst.

Coccus mangiferae Green.

Icerya aegyptiaca Dougl.

Pulvinaria psidii Mask.

Saissetia hemisphaerica Targ.

Punica granatum (Lythrariceae)

Ferrisia virgata Ckll.

Pygeum preslii (Rosaceae)

Ceroplastes ceriferus And.

Quercus sp. (Cupuliferae)

Kermes formosanus Takah.

Rhodea japonica (Liliaceae)

Coccus hesperidum L.

Rhododendron sp. (Ericaceae)

Pseudococcus lilacinus Ckll.

Rhodomyrtus tomentosa (Myrtaceae)

Ceroplastes ceriferus And.

C. floridensis Comst.

Laccifer greeni Chamb.
Tachardina theae Green et Mann.

Rhus vernicifera (Anacardiaceae)
Coccus hesperidum L.
Saissetia formicarii Green.
S. hemisphaerica Targ.

Rhus sp.
Coccus elongatus Signt.
Saissetia formicarii Green.
S. hemisphaerica Targ.

Rosa sp. (Rosaceae)
Aulacaspis rosae Bouche.
Chrysomphalus aonidum L.
Icerya purchasi Mask.

Saccharum officinarum (Gramineae)
Aulacaspis tegalensis Zehnt.
Lecanopsis sacchari Takah.
Mizococcus sacchari Takah.
Pseudococcus saccharicola Takah.
Trionymus diminutus Leon.
T. sacchari Ckll.

Salix warburgii (Salicineae)
Lepidosaphes tubulorum Ferris.
Saissetia formicarii Green.
S. nigra Nietn.

Sapium sebiferum (Euphorbiaceae)
Icerya seychellarum Westw.
Lepidosaphes tubulorum Ferris.
Saissetia formicarii Green.
S. nigra Nietn.

Schima confertiflora (Ternstroemiaceae)
Ceroplastes floridensis Comst.
Tachardina theae Green et Mann.

Schima noranhae

Formicococcus schimae Takah.
Saissetia formicarii Green.
Scolopia crenata (Bixineae)
Diaspis major Ckll.
Sideroxyron ferrugineum (Sapotaceae)
Asterolecanium corallinus Takah.
Spinifex littoreus (Gramineae)
Chionaspis graminis Green var. divergens Green.
Tabernaemontana sp. (Apocynaceae)
Saissetia hemisphaerica Targ.
Tamarindus indica (Leguminosae)
Pseudococcus lilacinus Ckll.
Tectona grandis (Verbenaceae)
Pseudococcus citri Risso.
P. lilacinus Ckll.
Saissetia oleae Bern.
Terminalia catappa (Combretaceae)
Coccus hesperidum L.
Saissetia nigra Nietn.
S. oleae Bern.
Terminalia chebula
Coccus hesperidum L.
Terminalia sp.
Pseudococcus lilacinus Ckll.
Ternstroemia japonica (Ternstroemiaceae)
Ceroplastes floridensis Comst.
Icerya seychellarum Westw.
Tetrapanax papyrifera (Araliaceae)
Pseudococcus citri Risso.
Thea chinensis (Ternstroemiaceae)
Aspidiotus cyanophylli Signt.
Cerococcus ficoides Green.
Ceroplastes ceriferus And.
C. floridensis Comst.
Chrysomphalus aonidum L.

Coccus hesperidum L.
Eriochiton theae Green.
Pinnaspis theae Mask.
Pseudococcus citri Risso.
P. filamentosus Ckll.
Saissetia formicarii Green.
S. hemisphaerica Targ.
Tachardina theae Green et Mann.

Thea japonica
Chrysomphalus aonidum L.
Ferrisia virgata Ckll.
Fiorinia fioriniae Targ.
Parlatoria pergandei Comst.
Pinnaspis theae Mask.
P. uniloba Kuw.
Pseudaonidia trilobitiformis Green.
Saissetia formicarii Green.

Thevetia sp. (Apocynaceae)
Chrysomphalus aonidum L.

Trachycarpus excelsus (Palmae)
Aspidiotus destructor Signt.

Thevetia sp. (Apocynaceae)
Chrysomphalus aonidum L.

Trachycarpus excelsus (Palmae)
Aspidiotus destructor Signt.

Vitex negundo (Verbenaceae)
Icerya purchasi Mask.

Vitis vinifera (Ampelideae)
Coccus elongatus Signt.

Zizyphus sp. (Rhamneae)
Pseudococcus filamentosus Ckll.

(Hosts unknown)
Coccus caudatus Green.
Drosicha dalbergiae Green.
Eriochiton formosae Takah.

Pinnaspis minor Mask.
Puto spinosus Robin.

Distribution and local abundance of the Coccidae in Formosa.

As is well known, the island of Formosa may by divided into southern and northern sections according to the differences in climatic conditions. The southern section is the area south of a line drawn between the hills of Sansa on the western coast and the cliff north of Karenko on the eastern. The coccid faunae of these two areas differ somewhat from one another. *Ferrisia virgata* Ckll., *Asterolecanium pustulans* Ckll., *Coccus viridis* Green, *Coccus acutissimus* Green, and *Laccifer greeni* Chamb. are common in the southern area, but are not found at all in the northern, although their host plants grow in the latter area also; while *Asterolecanium coralinus* Takah. and *Ceroplastodes chiton* Green are seen only in the north.

There are many insects that are abundant throughout the entire area of their distribution, and, on the other hand, there are some species that range over large areas but are abundant only in certain localities within their geographic range.

We find good illustrations of such facts in the Coccidae of Formosa. *Icerya aegyptiaca* Dougl., *Eucalymnatus tessellatus* Signt., *Ceroplastes rubens* Mask., and *Fiorinia theae* Green, are common in the south but extremely scarce in the north, whereas *Pseudococcus citri* Risso, *Saissetia hemisphaerica* Targ., *Saissetia formicarii* Green, *Chrysomphalus aonidum* L., and many others are abundant throughout the lowlands of the island. In this connection it is very noticeable that *Ceroplastes rubens* Mask., which occurs in abundance in Japan proper, is more common in the southern area than in the northern part of the island. The coccid fauna of the high mountains is also different from that of the lower levels in Formosa. On the higher levels there are fewer species of the insects, but there are found the interesting species, *Kermes formosanus* Takah. and *Newsteadia* sp.

Coccidae associated with Cremastogaster rogenhoferi Mayr. in Formosa.

Cremastogaster rogenhoferi Mayr. is one of the most abundant insects throughout the lowlands of Formosa. It constructs conspicuous nests around the branches of trees and has associated with it various insects, of which the coccids far outnumber the others in number of species, playing the most important role in the economy of this ant. In almost every nest of this ant there exists one or more

species of coccids. The ant also visits the honey glands on the leaves of *Terminalia* and *Clerodendron*, sometimes protecting the openings of the glands with shelters. The habit, reported for other species, of carrying the myrmecophile in the mouth is not found in this ant.

The coccids living in association with this ant may be arranged in the following categories:

(1) True myrmecophiles. These are protected always by this ant and can not live without the association, showing the most advanced stage of trophobiosis.

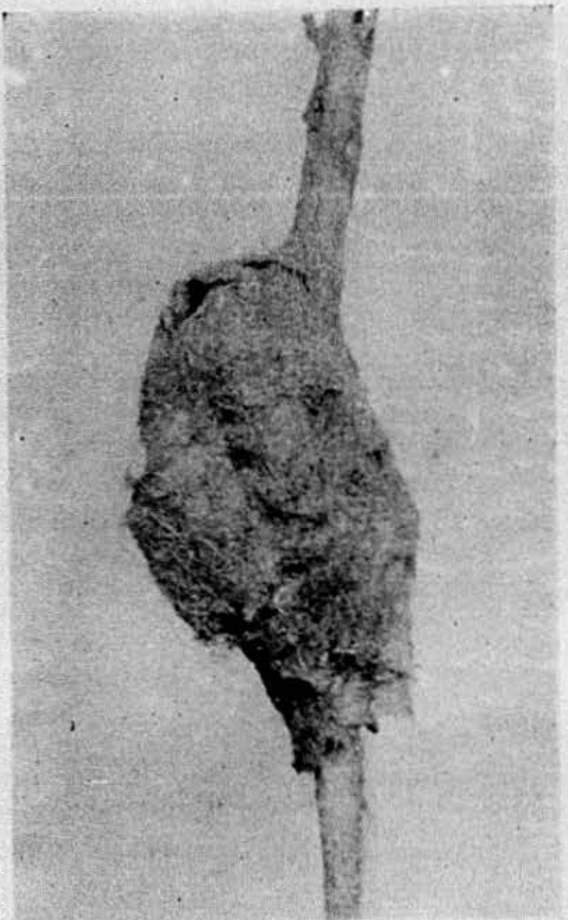
Saissetia formicarii Green and *Anomalococcus* sp. are always found in the nests or shelters which are often called tents, but are not found outside of them. *Formicococcus cinnamomi* Takah., *F. schimae* Takah., and *Lecaniodiaspis cremastogastri* Takah. are always found protected within the tents, but have not been found in the nests.

(2) Coccids which are almost always protected by this ant, but are sometimes found away from it.

Pseudococcus lilacinus Ckll., *Pilococcus miscanthi* Takah., *Coccus hesperidum* L. and *Laccifer greeni* Chamb., belong to this group. They are almost always found protected in the tents, but may occasionally be found not associated with this ant. *Pseudococcus lilacinus* Ckll. and *Coccus hesperidum* L. live also in the nests and the former is sometimes attended by *Plagiolepis longipes* Smith.

(3) Coccids which are sometimes found in the tents, being visited by the ant.

Trionymus latus Takah., *Pseudococcus adonidum* L., *Ripersia cellulosa* Hall, *Saissetia hemisphaerica* Targ., *S. nigra* Nietn., *S. oleae* Bern.,

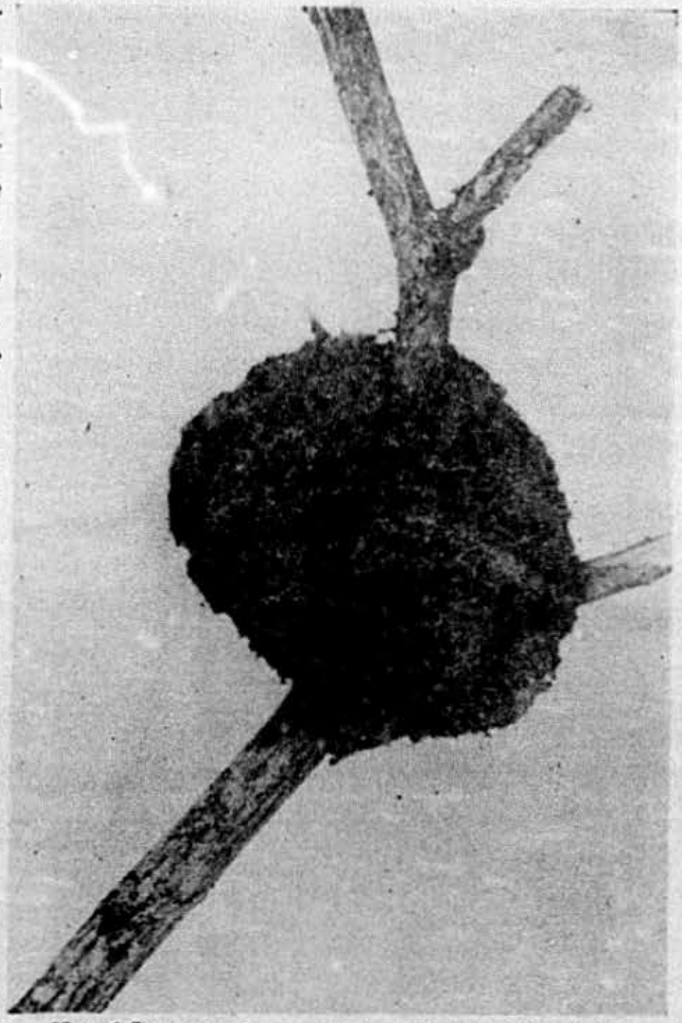


Tent of *Cremastogaster rogenhoferi*. (Photo. by K. Fukuda)

Coccus elongatus Signt., *Eucalymnatus tessellatus* Signt *Pulvinaria psidii* Mask, and *P. polygonata* Ckll., are occasionally protected with the tents, but are not found in the nests. *Eucalymnatus tessellatus* Signt. is occasionally found in the nest of *Cremastogaster* sp.

(4) Coccids which are sometimes visited by the ant but are not found in the tents or nests. *Pseudococcus citri* Risso and *Ceroplastes rubens* Mask. are the illustrations of this type. This is the most primitive type of the association between the coccids and the ant.

(5) Coccids which are merely accidental in the nests or tents. *Chrysomphalus aonidum* L. mixed in the colonies of other myrmecophilous species are sometimes found in the nests or tents.



Nest of *Cremastogaster regenhoferi*. (Photo. by K. Fukuda)

Among the coccids mentioned above, *Anomalococcus* and *Formicococcus* are the only genera all of whose species are known to be myrmecophilous. These genera in comparison with their allies have softer skins; and the true myrmecophilous species, *Saissetia formicarii* Green, is also likewise provided with a skin softer than that of other species of *Saissetia*, which are not true myrmecophiles.

The Formosan coccids in association with this ant belong to the subfamilies Pseudococcinae, Asterolecaniinae, Coccinae, and Lacciferinae; and there are no such myrmecophilous species in the subfamilies Monophlebinae, Dactylopiinae, Ortheziinae, and Diaspinae. The species of Monophlebinae seem to be too large to be protected by this ant and those of Dactylopiinae and Ortheziinae are found on high

mountains where the ant does not live. The coccids of the Diaspinae appear to use honey-dew in forming the scales, scarcely putting the dew out of the scales, and probably for this reason they are not attended by this ant.

The association with this ant appears to be a very profitable form of existence in some coccids at least. For example, *Saissetia formicarii* Green is always protected by this ant and is rarely killed by parasites, being found abundantly throughout the year, while *Saissetia hemisphaerica* Targ., *S. nigra* Nietn. and *S. oleae* Bern., which are not true myrmecophiles, are often killed by their parasites and are much fewer in number than the former.

List of the Formosan Coccidae, with descriptions of new species.

Subfamily Monophlebinae.

Drosicha sp.

Drosicha maskelli, Takahashi, Philippine Jl. Sc., xxxvi, p. 328 (1928).

Hosts.—*Citrus* sp. (Rutaceae), *Ficus retusa* (Urticaceae).

Hab.—Taihoku, Kuraru.

This species is rare, occurring in small numbers on *Ficus retusa* in Taihoku and is sporadic in habit. An adult female was collected by me on a *Citrus* at Kuraru on June 28, 1928. This species was recorded by me under the name of *Drosicha maskelli* Ckll. in the previous paper, but Dr. H. Morrison has kindly examined the Formosan specimens and writes me that they differ somewhat from *Drosicha maskelli* Ckll. and may be new to science; and I treat the Formosan species here as *Drosicha* sp.

Drosicha contrahens Walk.

Fernald, Cat. Cocc. World, p. 18 (1903); Green, Ann. Mag. Nat. Hist., ser. 9, xii, p. 68 (1923); Takahashi, Philippine Jl. Sc., xxxvi, p. 328 (1928).

Host.—*Persea gratissima* (Laurineae).

Hab.—Kagi.

This species has been collected only once in Formosa.

Drosicha dalbergiae Green.

Monophlebus dalbergiae, Green, Ind. Mus. Not., v, p. 101 (1902); Proc. 5th Ent. Meet. Pusa, 1923, p. 338 (1924).

Drosicha dalbergiae, Vayssiere, Ann. Epiph., xii, p. 274 (1926); Takahashi, Philippine Jl. Sc., xxxvi, p. 329 (1928).

Host.—Unknown in Formosa.

Hab.—Tansui, Urai.

This species seems to be very rare in Formosa, only 3 specimens having been collected.

Icerya aegyptiaca Dougl.

Fernald, Cat. Cocc. World, p. 24 (1903); Shiraki, Agr. Expt. St. Formosa, Spec. Rept., 8, p. 101 (1913); Morrison, Philippine Jl. Sc., xvii, p. 152 (1920); Green, Cocc. Ceylon, v, p. 439 (1922); Takahashi, Philippine Jl. Sc., xxxvi, p. 329 (1928).

Hosts.—*Anona muricata* (Annonaceae), *Artocarpus incisa* (Urticaceae), *A. integrifolia*, *Celtis* sp. (Urticaceae), *Codiaeum variegatum* (Euphorbiaceae), *Ficus wightiana* (Urticaceae), *Mallotus philippensis* (Euphorbiaceae), *Morus alba* (Urticaceae), *Psidium guyava* (Myrtaceae), *Psychotria elliptica* (Rubiaceae).

Hab.—Shirin, Kagi, Kanshirei, Tainan, Takao, Heito, Taito, Chippon.

This species is very common in the southern part of Formosa, sometimes occurring in large numbers, but is extremely scarce in the northern. Sometimes attended by *Plagiolepis longipes*.

Icerya seychellarum Westw.

Fernald, Cat. Cocc. World, p. 27 (1903); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 148 (1917); Morrison, Philippine Jl. Sc., xvii, p. 151 (1920); Ferris, Bull. Ent. Res., xii, p. 211 (1921); Green, Cocc. Ceylon, v, p. 440 (1922); Kuwana, Imp. Pl. Quar. St. Bull., 2, p. 30 (1922); Vayssiere, Ann. Epiph., xii, p. 340 (1926); Takahashi, Philippine Jl. Sc., xxxvi, p. 329 (1928).

Icerya okadae, Kuwana, Imp. Agr. Expt. St. Bull., i, 2, p. 178 (1907); Shiraki, Arg. Expt. St. Formosa, Spec. Rept., 8, p. 103 (1913).

Hosts.—*Areca catechu* (Palmae), *Chrysophyllum cainito* (Sapotaceae), *Citrus* spp. (Rutaceae), *Eriobotrya japonica* (Rosaceae) *Eugenia javanica* (Myrtaceae), *Ficus wightiana* (Urticaceae), *Maba buxifolia* (Ebenaceae), *Mangifera indica* (Anacardiaceae), *Machilus* sp. (Laurineae), *Morus alba* (Urticaceae), *Palaquium formosanum* (Sapotaceae) *Podocarpus macrophylla* (Coniferae), *Persea gratissima* (Laurineae), *Psidium guyava* (Myrtaceae), *Sapium sebiferum* (Euphorbiaceae), *Ternstroemia japonica* (Ternstroemiaceae).

Hab.—Taihoku, Shinten, Tosei, Hori, Kagi, Kanshirei, Tainan, Botel Tobago. Very common throughout the island, but occurring in very small numbers.

Icerya purchasi Mask.

Fernald, Cat. Cocc. World, p. 25 (1903); Shiraki, Rept. Stud. on Icerya purchasi, Taihoku (1911) and Agr. Expt. St. Formosa, Spec. Rept., 8, p. 102 (1913); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 142 (1917); Morrison, Philippine Jl. Sc., xvii, p. 151 (1920); Ferris, Bull. Ent. Res., xii, p. 211 (1921); Green, Cocc. Ceylon, v, p. 436 (1922); Kuwana, Imp. Pl. Quar. St., Bull., 2, p. 2 (1922); Morrison, Proc. U. S. Nat. Mus, 62, p. 34 (1923); Vayssiere, Ann. Epiph., xii, p. 337 (1926); Takahashi, Philippine Jl. Sc., xxxvi, p. 329 (1928).

Hosts.—*Acacia confusa* (Leguminosae), *Artemisia capillaris* (Compositae), *Citrus* spp. (Rutaceae) *Rosa* sp. (Rosaceae), *Vitex negundo* (Verbenaceae).

Rather common throughout the island, *Acacia confusa* occasionally getting a heavy infestation in summer. Sometimes visited by *Polyrhachis dives*.

Subfamily Pseudococcinae.

Pseudococcus citri Risso.

Fernald, Cat. Cocc. World, p. 99 (1903); Newstead, Mon. Brit. Cocc., ii, p. 164 (1903); Sanders, Jl. Econ. Ent. ii, p. 432 (1907); Leonardi, Mon. Cocc. Ital., p. 383 (1920); Ferris, Bull. Ent. Res., xii, p. 211 (1921); Green, Cocc. Ceylon, v, p. 375 (1922); Ferris, Boll. Lab. Zool. R. Scuola. Agr. Portici, xvi, p. 209 (1922); Morrison, Jl. Agr. Res., xxxi, p. 498 (1925); Takahashi, Philippine Jl. Sc., xxxvi, p. 329 (1928).

Hosts.—*Acacia confusa* (Leguminosae), *Artocarpus incisa* (Urticaceae), *A. integrifolia*, *Bryophyllum calycinum* (Crassulaceae); *Blumea balsamifera* (Compositae), *Calathea tubispatha* (Orchideae), *Carludovica palmata* (Palmae), *Citrus* spp. (Rutaceae), *Clausena wampi* (Rutaceae), *Ixora chinensis* (Rubiaceae) *Lespedeza* sp. (Leguminosae), *Morus alba* (Urticaceae), *Passiflora edulis* (Passiflorae), *Persea gratissima* (Laurineae), *Psidium guyava* (Myrtaceae), *Tectona grandis* (Verbenaceae), *Tetrapanax papyrifera* (Araliaceae), *Thea chinensis* (Ternstroemiaceae)

Hab.—Hokuto, Taihoku, Hori, Kagi, Shinka, Heito, Koshun, Karenko, Riran, Taito.

Very common throughout the year, sometimes occurring in abundance.

Pseudococcus adonidum L.

Leonardi, Mon. Cocc. Ital., p. 399 (1920); Takahashi, Philippine Jl. Sc., xxxvi, p. 330 (1928).

Hosts.—*Areca catechu* (Palmae), *Calophyllum inophyllum* (Guttiferae), *Citrus* spp. (Rutaceae), *Ficus retusa* (Urticaceae), attacking chiefly the air root, *Gardenia florida* (Rubiaceae), *Helicio cochinchinensis* (Proteaceae), *Magnolia* sp. (Magnoliaceae), *Prunus communis* (Rosaceae), *Psidium guyava* (Myrtaceae).

Hab.—Tansui, Taihoku, Shoka, Gojo, Rengechi, Heito, Kurarn.

This species is very common in Formosa and is most so on *Ficus retusa* in summer, but is extremely few on *Citrus*. Sometimes protected with shelters by *Cremastogaster rogenhoferi* Mayr. I observed a few females of this mealy bug associated with this ant in an empty gall produced by a Coleopteron on a branch of *Helicia cochinchinensis* at Reugechi.

Pseudococcus comstocki Kuw.

Fernald, Cat. Cocc. World, p. 100 (1903); Takahashi, N., Agr. Expt. St. Niigata, Spec. Rept., 23 (1927).

This species was recorded by Ferris (Bull. Ent. Res., xii, p. 211, 1921) from *Citrus* in Taihoku, but I have not found it in Formosa.

Pseudococcus saccharicola Takah.

Philippine Jl. Sc., xxxvi, p. 331 (1928).

Host.—*Saccharum officinarum* (Gramineae).

Hab.—Shinka.

Pseudococcus brevipes Ckll.

Fernald, Cat. Cocc. World, p. 98 (1903); Cockerell, Science, n. ser., lv, 1492, p. 351 (1922); Takahashi, Philippine Jl. Sc., xxxvi, p. 330 (1928).

Pseudococcus bromeliae, Ferris, Jl. Econ. Ent., xii, p. 296 (1919); Morrison, Philippine Jl. Sc., xvii, p. 173 (1920); Green, Cocc. Ceylon, v, p. 381 (1922); Morrison, Psyche, xxix, p. 133 (1922); Hall, Bull. Soc. Roy. Ent. Egypte, 1926, p. 156 (1927).

Host.—*Ananas sativus* (Bromeliaceae).

Hab.—Shirin, Kagi, Hozan.

Common, sometimes occurring in abundance. Wheeler records that this

coccid lives in association with the beetle, *Coccidotrophus socialis* (Social life among the insects, 1923), but such a fact has not been observed in Formosa.

Pseudococcus lilacinus Ckll.

Proc. Dav. Acad. Sc., x, p. 128 (1905); Robinson, Philippine Jl. Sc., D, xii, p. 7 (1917); Morrison, Philippine Jl. Sc., xvii, p. 176 (1920); Green, Cocc. Ceylon, v, p. 380 (1922); Ferris, Boll. Lab. Zool. R. Scuola Agr., Portici, xvi, p. 209 (1922); Takahashi, Philippine Jl. Sc., xxxvi, p. 330 (1928).

Hosts.—*Acacia confusa* (Leguminosae), *Anona reticulata* (Anonaceae), *Areca oleracea* (Palmae), *Artocarpus incisa* (Urticaceae), *A. integrifolia*, *Bauhinia purparea* (Leguminosae), *Callicarpa formosana* (Verbenaceae), *Citrus* sp. (Rtaceae), *Codiaeum variegatum* (Euphorbiaceae), *Erythrina* sp. (Leguminosae), *Eugenia jambos* (Myrtaceae), *E. javanica*, *Gardenia florida* (Rubiaceae), *Heritiera littoralis* (Sterculiaceae), *Macaranga dipterocarpifolia* (Euphorbiaceae), *M.* sp., *Mallotus japonicus* (Euphorbiaceae), *M.* sp., *Rhododendron* sp. (Ericaceae), *Tamarindus indica* (Leguminosae), *Tectona grandis* (Verbenaceae), *Terminalia* sp. (Combretaceae).

Hab.—Hokuto, Taihoku, Shinten, Taichu, Hori, Kagi, Toko, Kuraru, Domon, Karenko, Botel Tobago.

This species is very common throughout the island, often occurring in abundance in the south part, but is extremely scarce on *Citrus*. The colonies of this species are usually protected by *Cremastogaster rogenhoferi* and are also sometimes visited by *Plagiolepis longipes*. A *Citrus* tree was found attacked by a few females in Koshun in June 1928.

Pseudococcus filamentosus Ckll.

Fernald, Cat. Cocc. World, p. 101 (1903); Morrison, Philippine Jl. Sc., xvii, p. 173 (1920); Ferris, Stanf. Univ. Pub. Biol. Sc., i, 2, p. 82 (1921) and Bull. Ent. Res., xii, p. 211 (1921); Takahashi, Philippine Jl. Sc., xxxvi, p. 330 (1928).

Hosts.—*Artocarpus integrifolia* (Urticaceae), *Broussonetia papyrifera* (Urticaceae), *Carissa carandas* (Apocynaceae), *Citrus* spp. (Rutaceae), *Coffea arabica* (Rubiaceae), *Eugenia javanica* (Myrtaceae), *Ficus retusa* (Urticaceae), *Gardenia florida* (Rubiaceae), *Musaenda luteola* (Rubiaceae), *Nerium odorum* (Apocynaceae), *Thea chinensis* (Ternstroemiaceae), *Zizyphus* sp. (Rhamneae).

Hab.—Taihoku, Giran, Kagi, Heito.

Very common, sometimes attended by *Polyrhachis dives*. The mealy-bug-devouring ladybird, *Cryptolaemus montrouzieri* Muls., has been introduced into Formosa to combat this species and other Pseudococcinae and has been established in the fields near Taihoku, but so far without much successful results.

Trionymus sacchari Ckll.

Pseudococcus sacchari, Fernald. Cat. Cocc. World, p. 109 (1903); Morrison, Philippine Jl. Sc., xvii, p. 173 (1920).

Trionymus sacchari, Morrison, Jl. Agr. Res., xxxi, p. 497 (1925); Takahashi, Philippine Jl. Sc., xxxvi, p. 333 (1928).

Hosts.—*Saccharum officinarum* (Gramineae), *Miscanthus* sp. (Gramineae).

Hab.—Shinka, Koshun, Kori,

This species is very plentiful, sometimes heavily infesting the cane. I observed a large colony of this mealy bug protected with tents by *Paratrechina* (*Nylanderia*) *bourbonica* Forel, subsp. *bengalensis* Forel* at Koshun in June 1928. Mr. Yashiro collected many specimens at Naha, Okinawa, in November 1927.

Trionymus diminutus Leon.

Pseudococcus diminutus, Leonardi, Boll. Lab. Zool. R. Scuola Agr., Portici, xii, p. 198 (1918) and Mon. Cocc. Ital., p. 397 (1920).

Trionymus diminutus, Morrison, Jl. Agr. Res., xxxi, p. 495 (1925); Takahashi, Philippine Jl. Sc., xxxvi, p. 332 (1928).

Host.—*Saccharum officinarum* (Gramineae).

Hab.—Byoritsu, Kori.

This species is rather common.

Trionymus pulverarius Newst. var. **bambusae** Green.

Pseudococcus pulverarius Newst. subsp. bambusae, Green, Cocc. Ceylon, v, p. 374 (1922).

Trionymus pulverarius Newst. var. bambusae, Takahashi, Philippine Jl. Sc., xxxvi, p. 333 (1928).

Host.—*Bambusa stenostachya* (Gramineae).

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* Identified by Mr. C. Teranishi.

Sometimes occurs in large numbers on the young shoots, and is covered with tents by *Pheidole* sp. at times.

Trionymus latus sp. nov.

(Adult female) Yellowish brown, somewhat covered with white powder and with a purplish tinge; the secretion forming no filaments.

Body broadly ovate, about 1.5 times as long as wide in mounted specimens, moderately convex on the dorsum. Antennae 8-jointed, a little longer than the hind tibia and tarsus taken together, with some bristles, some of which are somewhat stouter and almost as long as the 7th antennal joint; the 1st joint a little wider than long, somewhat dilated towards the base, much wider than the 2nd; the 2nd a little longer than wide, with a very small circular sensorium at the tip; the 3rd a little longer than wide; the 4th almost as long as wide, not well defined from the 3rd and 5th; the 5th subcylindrical; the 6th a little longer than wide; the 7th somewhat narrowed towards the base, with a stouter bristle near the tip; the 8th about thrice as long as wide, with 3 stouter bristles; the relative length of joints about as follows: I—10, II—10, III—8, IV—5, V—9, VI—7, VII—8, VIII—18.

Eyes submarginal, almost as large as the 4th antennal joint. Rostrum conical, somewhat longer than wide, 2-jointed. Legs rather short; coxae rather large; hind coxae with numerous very small transparent pores of various size in a group along the whole length; trochanters with 4 circular pores and a very long bristle at the tip; femora a little longer than the tibia, not swollen, with some bristles; hind femora with some very faint large areolations, about 4 times as long as wide; tibiae with a few bristles and 2 shorter stouter setae near the end; hind tibiae more slender than the 2nd antennal joint, about 1.8 times as long as the tarsus, without pores; tarsi with 2 very long slender digitules which are longer than the claw; hind tarsi a little longer than the last antennal joint; claw digitules more distinctly capitate than the tarsal one. Spiracles of normal shape, expanded on the distal end, slightly shorter than the last antennal joint, without pores on the side of the orifice, with a few large areolations on the basal part; the hind ones a little stouter. Anal ring almost circular, strongly chitinized between the rows of pores along the whole margin, with 6 setae which are as long as or somewhat longer than the diameter of the ring; pores arranged regularly in 2 rows, the pores in the outer row almost as large as those in the

inner, but smaller than the circular pore on the venter. Anal lobes somewhat protuberant, the apical setae a little more than twice as long as, and stouter than, the seta of the anal ring. 3 posterior pairs of cerarii present, each with 2 small spines; the last cerarii not more chitinized, not underlaid by chitinous thickening, with some minute pores in loose cluster, the spines conical, sharply pointed, more than thrice as long as wide; the remaining 2 pairs of cerarii not more chitinized, with a few minute pores and 2 spines which are more slender, but sometimes somewhat longer than, the spine of the last pair; about 4-7 spine-like setae present around each of the anterior 4 cerarii, these accessory setae somewhat variable in length, some of which are a little longer than the cerarian spine, but more slender. Anterior and posterior dorsal ostioles small, equal in size. Abdomen with a small, oval cicatrix at the middle of the venter which is smaller than the ostiole. Body with many moderately long bristles which are shorter than the seta of the anal ring, but almost as long as those on the antenna, without longer setae on the posterior extremity. Numerous minute triangular pores scattered over the whole surface; many larger circular pores present only on the posterior portion of the venter in a large cluster around the genital opening and 2 transverse rows in front of the genital cluster, these rows and cluster not reaching the body side, the number of these circular pores as follows: about 65 in the genital cluster, about 20-27 in the posterior row, 0-6 in the anterior row; a few very short tubular ducts present on the distal portion.

(Adult female)
(1).....Hind leg.
(2).....Hind spiracle.
(3).....Antepenultimate cerarus and accessory setae.

Length of body—about 3.0 mm. Antenna—about 0.34612 mm.

Hind coxa—about 0.14768 mm. Hind femur—about 0.20767 mm.
Hind tibia—about 0.18 mm. Hind tarsus—about 0.1015 mm.
Anal seta—about 0.1848 mm. Longest cerarian spine—about 0.019 mm.
Longest diameter (including pore-rows) of anal ring—about 0.07845 mm.
Cicatrix—about 0.0553 mm. Ostiole—about 0.08768 mm.
Circular pore on venter—about 0.0086 mm.

Hosts.—*Miscanthus sinensis* (Gramineae), Miscanthus sp.

Hab.—Taihoku, Shinten.

This species is different from all other known species of the genus in the wider body. Rather common, sometimes being protected by *Cremastogaster rogenhoferi*.

Ferrisia virgata Ckll.

Pseudococcus virgatus, Fernald, Cat. Cocc. World, p. 111 (1903); Ferris, Jl. Econ. Ent., xii, p. 297 (1919); Morrison, Philippine Jl. Sc., xvii, p. 171 (1920); Ferris, Bull. Ent. Res., xii, p. 211 (1921); Green, Cocc. Ceylon, v, 371 (1922).

Ferrisia virgata, Fullaway, Proc. Hawaii. Ent. Soc., v, p. 311 (1923); Morrison, Jl. Agr. Res., xxxi, p. 497 (1925); Takahashi, Philippine Jl. Sc., xxxvi, p. 335 (1928).

Hosts.—*Acalypha* sp. (Euphorbiaceae), *Allophylus rheedi* (Sapindaceae), *Anona squamosa* (Anonaceae), *Artocarpus integrifolia* (Urticaceae), *Bauhinia* sp. (Leguminosae), *Bombax malabaricum* (Malvaceae), *Calliandra haematocephala* (Leguminosae), *Casuarina equisetifolia* (Casuarineae), *Citrus* sp. (Rutaceae), *Coffea arabica* (Rubiaceae), *Codiaeum veriegatum* (Euphorbiaceae), *Eugenia javanica* (Myrtaceae), *Euphorbia pulcherrima* (Euphorbiaceae), *Ficus retusa* (Urticaceae), attacking the air root, *Inocarpus edulis* (Leguminosae), *Nerium odorum* (Apocynaceae), *Persea gratissima* (Laurineae), *Plumeria acutifolia* (Apocynaceae), *Psidium guyava* (Myrtaceae), *Punica granatum* (Lythrarieae), *Thea japonica* (Ternstroemiaceae).

Hab.—Rinnai, Kanshirei, Gaishatei, Hori, Taichu, Tosei, Kagi, Shinka, Tainan, Heito, Koshun, Taito, Karenko, Kontei.

This species is fairly common in the southern section of Formosa, but is not discovered in the northern.

Ripersia cellulosa Hall.

Minist. Agr. Egypt. Tech. Sc. Serv., Bull. xxxvi, p. 7 (1923); Bull. lxxii, p. 30 (1926); Takahashi, Philippine Jl. Sc., xxxvi, p. 335 (1928).

Trionymus miscanthi, Takahashi, Philippine Jl. Sc., xxxvi, p. 333 (1928).

Hosts.—*Bambusa* sp. (Gramineae), *Miscanthus sinensis* (Gramineae).

Hab.—Taihoku.

The Formosan specimens somewhat differ from Hall's description, but seem to belong to this species. This species is plantiful near Taihoku on *Miscanthus*, sometimes being protected by *Cremastogaster*, and is found under the leaf-sheath, often closely flattened against the stalk.

Pilococcus miscanthi Takah.

Trans. Nat. Hist. Soc. Formosa, xviii, p. 257 (1928).

Hosts.—*Miscanthus sinensis* (Gramineae), *Miscanthus* sp.

Hab.—Urai, Shinten, Takeyama, Kurarn.

This species is almost always protected with tents by *Cremastogaster rogenhoferi*.

Formicococcus cinnamomi Takah.

Trans. Nat. Hist. Soc. Formosa, xviii, p. 253 (1928).

Host.—*Cinnamomum camphora* (Laurineae).

Hab.—Hokuto, Taihoku.

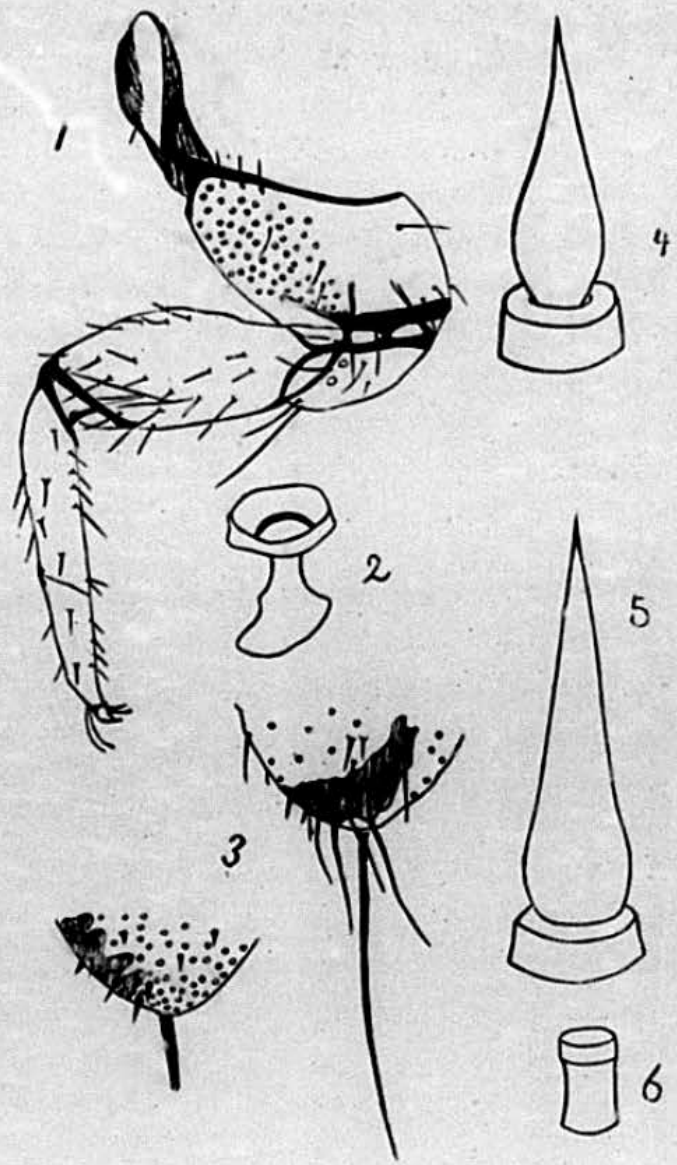
This species is found in the crevices on the branches, stems or roots, or under the barks, of the grown host trees, always being protected by *Cremastogaster rogenhoferi*.

Formicococcus schimae sp. nov.

(Adult female) Dark purplish brown in dried specimens, densely covered with white powder. Body broadly oval, moderately convex on the dorsum, about 1.45 times as long as wide in mounted specimens. Eyes submarginal, almost as large as the 5th antennal joint. Antennae 9-jointed, with some long bristles which are almost as long as the 5th joint; the 1st joint a little wider than long; the 2nd about 1.3 times as long as wide, with a very small circular pore at the tip; the 3rd about twice as long as wide; the 4th as long as wide; the 5th very slightly longer than wide; the 6th slightly narrowed towards the base, as long

as wide; the 7th and 8th about 1.5 times as long as wide, each with a stouter bristle; the 9th about 1.5 times as long as wide, with 2 stouter bristles; the relative length of joints about as follows: I—11, II—10, III—11, IV—6, V—7, VI—7, VII—9, VIII—8, IX—10. Beak long, conical, about twice as long as wide, pointed, 2-jointed. Spiracles of equal shape, but the posterior pair a little larger, widely expanded at the distal end, less so on the base, without pores on the side of the orifice, shanks rather slender. Legs stout, with some long rather fine bristles; hind legs somewhat larger; hind coxae very large, with numerous very small circular pores over the whole length; trochanters with 2 very small circular pores; femora very stout, slightly swollen, hind femora about 2.6 times as long as wide, a little longer than the tibia; hind tibiae about 4 times as long as wide, about 1.7 times as long as the tarsus, with 2 stouter setae near the tip, but no pores; tarsi somewhat tapering, front tarsi almost as stout as the 2nd antennal joint, about thrice as long as wide, slightly longer than the hind spiracle; digitules long, slender, somewhat capitate; claws without denticles, digitules stouter than the tarsal one. Anterior and posterior dorsal ostioles developed, almost equal in size. A rather large quadrate cicatrix with rounded corners present at the middle of the venter, which is as long as the posterior dorsal ostiole. Anal ring circular, almost as long in diameter as the dorsal ostiole, with 6-11 long setae which are narrowed on the distal half and some of which are somewhat shorter; the longer ones a little longer than the diameter of the ring; pores arranged in 2 rows, those in the outer row smaller, circular, regularly arranged, more than 60 in number. Anal lobes distinctly protruding, somewhat more chitinized, with many long bristles on the lower side and about 3 or 4 spines (besides the cerarian spines) which are as long as or slightly longer than the cerarian spine; apical setae as stout as, but about twice as long as, the seta of the anal ring. 18 pairs of cerarii present along the whole margin of body, of which 4? pairs are on the head, each with numerous minute triangular pores in a loose cluster, anterior 3 pairs a little protruding; the 1st pair each with 3 or 4 spines; the 2nd and 3rd each with 3 spines; all the remaining pairs each with mostly 2, but sometimes 3, spines; these spines conical, sharply pointed, somewhat constricted at the base, very small; the last cerarian spines somewhat larger; about 2-5 small accessory spines present around each of the posterior about 5-10 pairs of cerarii, which are almost as long as or shorter than the cerarian

spine. Body with pores of 3 types; numerous minute triangular pores distributed over the whole surface, especially abundant in front of and behind the dorsal ostiole; about 40 larger circular pores around the genital opening and about 7-10 similar ones in an irregular transverse row in front of the genital group; these circular pores larger than the pore of the anal ring; the cluster and row not reaching the body margin; about 7-20 short stout tubular ducts in a very loose cluster present on the ventral side near each cerarus excepting the last one, these ducts almost as long as the dorsal spine, about twice as long as wide, almost equal in diameter to the ventral circular pore, fewer in number anteriorly; some a little smaller similar ducts scattered in front of the genital cluster of circular pores on the venter. Dorsum with many minute spines sparsely scattered, which are swollen on the basal half, sometimes slightly curved at the tip, sharply pointed; venter with many long bristles which are as long as or somewhat longer than those on the antenna.



(Adult female)

(1).....Posterior leg.
(2).....Posterior spiracle.
(3).....Anal lobe.
(4).....Dorsal spine.
(5).....Cerarian spine.
(6).....Duct.

Length of body—about 2.6 mm. Antenna—about 0.3692 mm.
Posterior spiracle—about 0.07845 mm. Hind femur—about 0.207675 mm.
Hind tibia—about 0.170755 mm. Hind tarsus—about 0.10153 mm.
Apical seta—about 0.23075 mm. Anal lobe—about 0.059 mm.
Larger tubular duct—about 0.00923mm. Last cerarian spine—about 0.0188mm.
Beak excepting basal part—about 0.27 mm.
Diameter of anal ring—about 0.0923 mm.

Host.—*Schima noronhae* (Ternstroemiaceae), attacking the branch.

Hab.—Suisha.

Some females protected with tents by *Cremastogaster rogenhoferi* were collected by the author in September 1928.

This species is different from *Formicococcus cinnamomi* Takah. in the following characters:

(1) Antennae 9-jointed. (2) Body with larger tubular ducts. (3) Spiracles more slender. (4) Anal lobes distinctly protruding, more widely more chitinized. (5) Anal ring with 6-11 setae. (6) Last antennal joint shorter. (7) Circular pores distributed in a cluster around the genital opening and in a row in front of the genital cluster. (8) Hind coxae with pores. (9) Dorsal spines stouter. (10) Cerarian spines constricted at the base. (11) Some setae present near the cerarus. (12) Setae of the anal ring mostly as stout as the apical seta.

Phenacoccus hirsutus Green.

Mem. Dept. Agr. Ind. ii, p. 25 (1908); Morrison, Philippine Jl. Sc., xvii, p. 169 (1920); Minist. Agr. Egypt. Tech. Sc. Serv. Ent. Ser., Bull. xvii (1921); Takahashi, Philippine Jl. Sc., xxxvi. p. 336 (1928).

Hosts—*Morus alba* (Urticaceae), *Hibiscus* sp (Malvaceae).

Hab.—Hokuto. Taihoku.

Very scarce and of on economic importance in Formosa.

Puto spinosus Robin.

Phenacoccus spinosus, Robinson, Philippine Jl. Sc., D, xiii, p. 145 (1918); Green, Cocc. Ceylon, v, p. 394 (1922); Takahashi, Philippine Jl. Sc., xxxvi, p. 335 (1928).

Puto spinosus, Morrison, Philippine Jl. Sc., xvii, p. 165 (1920).

Host.—Unknown in Formosa.

Hab.—Hatsune near Karenko.

Puto mangiferae Green.

Phenacoccus mangiferae, Fernald, Cat. Cocc. World, p. 92 (1903); Green, Cocc. Ceylon, V, p. 393 (1922).

Host.—*Bladhia morissonensis* (Myrsineae), attacking the lower side of the leaf.

Hab.—Suisha.

Some immature females were collected by me in September 1928. New to Formosa.

Mizococcus sacchari Takah.

Philippine Jl. Sc., xxxvi, p. 336 (1928).

Hosts.—*Miscanthus* sp. (Gramineae), *Saccharum officinarum* (Gramineae), a plant of the Gramineae, attacking the root.

Hab.—Kori, Shinka.

This species is completely subterranean in habit, forming a complete sac and is common. A fungus is found in enormous numbers in the sac formed by this insect and the coccid seems to live in symbiotic relation with this fungus, supplying it with honey-dew and receiving from it protection like *Pseudococcus cryptus* Hempel (Pickel, Rev. Appl. Ent., A, xvi, p. 500, 1928).

Antonina crawi Ckll.

Fernald, Cat. Cocc. World, p. 121 (1903); Kuwana, Illust. Mon. Cocc. Jap., ii, p. 127 (1917); Ferris, Bull. Ent. Res., xii, p. 211 (1921); Takahashi, Philippine Jl. Sc., xxxvi, p. 338 (1928).

Host.—*Bambusa* sp. (Gramineae).

Hab.—Taihoku.

Antonina indica Green.

Men. Dept. Agr. Ind., Ent. Ser., ii, p. 27 (1908); Cocc. Ceylon, v, p. 395 (1922); Takahashi, Philippine Jl. Sc., xxxvi, p. 338 (1928).

Host.—A plant of the Gramineae.

Hab.—Taihoku, Kori.

Antonina bambusae Mask.

Ferris, Bull. Ent. Res., xii, p. 211 (1921); Green, Cocc. Ceylon, v, p. 397 (1922); Takahashi, Philippine Jl. Sc. xxxvi, p. 339 (1928).

Chaetococcus bambusae, Morrison, Proc. U. S. Nat. Mus., 60, Art. 12, p. 55 (1922).

Hosts.—*Bambusa stenostachya* (Gramineae), *Bambusa* sp.

Hab.—Taihoku, Hokuto, Shirin, Takeyama, Kagi, Hori, Okayama.

Very common, sometimes occurring in large numbers, but not destructive.

Subfamily Ortheziinae

Newsteadia sp.

Some immature females were collected by me on a moss and a fungus on decayed trees at Arisan (altitude about 7000 feet) on July 5, 1928. This species seems to differ from all the known species of the genus, but I hesitate to give a new name to it, since the adult has not been collected.

The immature females are pale yellowish and possess 6-jointed antennae, without chitinous thickenings on the abdomen. The last antennal joint is longer than the 1st. The body spines are tapering, somewhat curved, and truncate at the tip.

The genus *Newsteadia* is new to Formosa, as well as to the Oriental Region.

Subfamily Asterolecaniinae.

Cerococcus ficoides Green.

Fernald, Cat. Cocc. World, p. 57 (1903); Green, Mem. Dept. Agr. Ind., i, p. 338 (1907); Ferris, Bull. Ent. Res., xii, p. 212 (1921); Takahashi, Philippine Jl. Sc., xxxvi, p. 339 (1928).

Hosts.—*Ficus retusa* (Urticaceae), attacking the air root, *Gardenia florida* (Rubiaceae), *Mallotus japonicus* (Euphorbiaceae), *Thea chinensis* (Ternstroemiaceae).

Hab.—Taihoku, Heitin, Koheki.

This species is rather common, sometimes occurring in large numbers.

Asterolecanium corallinus Takah.

Philippine Jl. Sc., xxxvi, p. 339 (1928).

Host.—*Sideroxylon ferrugineum* (Sapotaceae).

Hab.—Keelung.

Very common on the host near the beach. This species forms depressions in the bark upon which it rests.

Asterolecanium pustulans Ckll.

Fernald, Cat. Cocc. World, p. 52 (1903); Ferris, Stanf. Univ. Pub., Univ. Ser, Biol. Sc., i, 2, p. 72 (1921); Takahashi, Trans. Nat. Hist. Soc. Formosa, xviii, p. 261 (1928).

Host.—*Nerium odorum* (Apocynaceae).

Hab.—Kagi, Koheki, Heito.

Rather common in the southern part, but is not found in the northern. The insects occupy depressions in the bark.

Asterolecanium bambusae Boisd.

Fernald, Cat. Cocc. World, p. 49 (1903); Newstead, Mon. Br. Cocc., ii, p. 151 (1903); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 81 (1917); Morrison, Philippine Jl. Sc., xvii, p. 161 (1921).

Hosts.—*Bambusa stenostachya* (Gramineae), *Bambusa* sp., *Dendrocalamus latiflorus* (Gramineae).

Hab.—Taihoku, Maruyama, Takeyama, Kagi.

Hitherto unrecorded from Formosa. This species is rather common, occurring, however, in small numbers, as it is checked by *Aphycus flavus* Howard.※

Asterolecanium tuberculatum Takah.

Asterolecanium bambusae Boisd. var. *tuberculata*, Takahashi, Philippine Jl. Sc., xxxvi, p. 339 (1928).

Host.—*Bambusa* sp. (Gramineae).

Hab.—Taihoku.

Anomalococcus sp.

Anomalococcus multipori, Takahashi, Philippine Jl. Sc., xxxvi, p. 339 (1928).

Hosts.—*Adinandra formosana* (Ternstroemiaceae), *Cinnamomum ceylanicum* (Laurineae), *Glochidion fortunei* (Euphorbiaceae), *G. hypoleuca*, *G.* sp.

Hab.—Sozan, Taihoku, Kuraru.

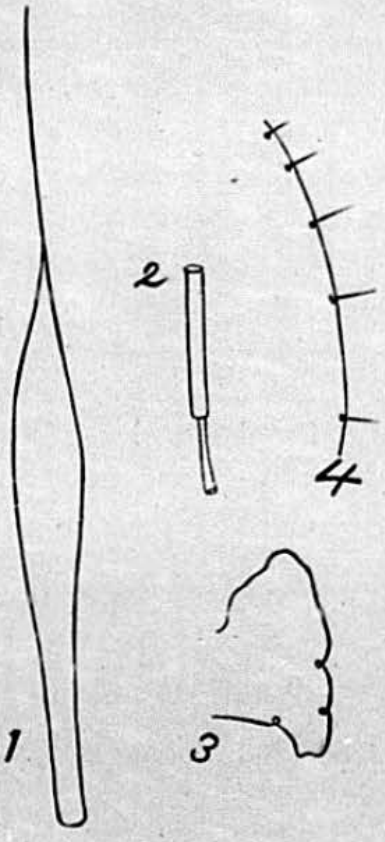
※ Identified by Mr. T. Ishii.

Near Taihoku this species is very common on *Glochidion* and is always protected with tents by *Cremastogaster rogenhoferi*. I observed this coccid in abundance in a large nest of this ant at Kurara in June 1928. This species was previously recorded by me under the name of *Anomalococcus multipori* Morrison, but Dr. Morrison has kindly examined my specimens and writes me that the Formosan *Anomalococcus* is distinct from *A. multipori* from Singapore, but is identical with an undescribed species of the genus from India sent him by Mr. E. E. Green.

Lecaniodiaspis cremastogastri sp. nov.

(Adult female) Test oval, rounded at both ends, very strongly convex, almost hemicircular when seen from side, with a distinct median longitudinal stout carina and about 9 shallow transverse fullows, compact, white, somewhat brownish, with no wax processes. Body broadly oval, very strongly convex on the dorsum. Antennae 8-jointed, without setae on the basal 5 joints; the 1st joint very short, wider than long; 2nd almost as long as wide; the 3rd and 4th a little longer than wide; the 5th twice as long as wide; the 6th as long as or slightly longer than wide, with a stout seta which is as long as the joint itself; the 7th as long as wide, with a similar seta; the 8th smallest, as long as wide, with some bristles, of which 2 are longer, stouter; the relative length of joints about as follows: I—6, II—8, III—10, IV—10, V—10, VI—6, VII—5, V—4. Legs wanting. Stigmatic clefts with abundant very small circular pores which are larger than the dorsal pore; anterior clefts with 2 spines of which one is longer, about twice as long as the shorter. almost as long as or very slightly longer than the dorsal bristle; posterior clefts with a spine which is nearly as long as the anterior longer one; these spines stout, somewhat curved, rounded at the apex. Body margin with some bristles in a row, which are subequal in length, almost as long as the longer bristle on the dorsum and some of them somewhat stouter. Anal ring with 9 or 10 very long flattened setae which are very stout on the basal portion, dilated on the middle, very slender on the apical portion, pointed at the tip, somewhat variable in length, reaching near the tip of the chitinized plate of anal cleft. Spiracles stout, stouter than the antenna, of equal size, expanded at the outer end and more so on the basal part, with no pores on the side of orifice. Numerous very small circular pores of equal size in a loose cluster connecting the spiracles with the body margin.

Anal cleft rather short, with numerous minute spinules on the marginal area as in *Lecaniodiaspis malaboda* Green; a pair of stout bristles which are a little longer than the marginal one present near the opening of the cleft; ventral bilobed plate strongly chitinized, reticulated near the side, with 2 small indentations on the side and 6 very short setae; each lobe almost triangular, rounded at the apex; dorsal median plate rounded, widely indented on the middle of the posterior margin, surrounding the anal ring with the ventral bilobed plate when seen from above. Dorsum with abundant minute paired pores over the whole surface which are equal in size, but sometimes slightly larger on the side; abundant slender tubular ducts over the whole surface which are of equal length, not curved, almost as long as the 2nd antennal joint; and some long simple bristles sparsely scattered which are somewhat variable in length. Venter with numerous very small circular multilocular pores in a large cluster at the middle of the distal portion and in about 5 transverse rows in front of the genital cluster, these pores slightly larger than the pore on the stigmatic cleft, somewhat larger in diameter than the tubular duct, very few in the anterior 3 rows; a pair of very long bristles and about 7 much shorter ones between the longer ones present at the middle of the distal portion; cribriform plates small, circular, of various size, 0-4 in number, strongly chitinized, with many pits in a rather dense group over the whole surface; a few long bristles present between the antennae.



(Adult female)
(1).....Seta of anal ring.
(2).....Tubular duct.
(3).. .....Bilobed plate.
(4).....Marginal setae.

Length of test—about 3.5 mm. Width of test—about 2.0-2.1 mm.
Height of test—about 2.0 mm. Length of body—about 2.6 mm.
Antenna—about 0.28 mm. Tubular duct—about 0.02769 mm.
Dorsal bristle—about 0.0554 mm. Marginal bristle—about 0.0554 mm.
Longest seta of anal ring—about 0.17537 mm. Spiracle—about 0.09 mm.

Longer stigmatic spine—about 0.0554 mm. Ventral bilobed plate—about 0.1246 mm. Bristle near opening of anal cleft—about 0.07845 mm. Diameter of cribriform plate—about 0.023 mm.

Ventral long bristle near anal cleft—about 0.1523 mm.

Host.—*Lithocarpus* sp. (Cupuliferae), attacking the branch.

Hab.—Hori.

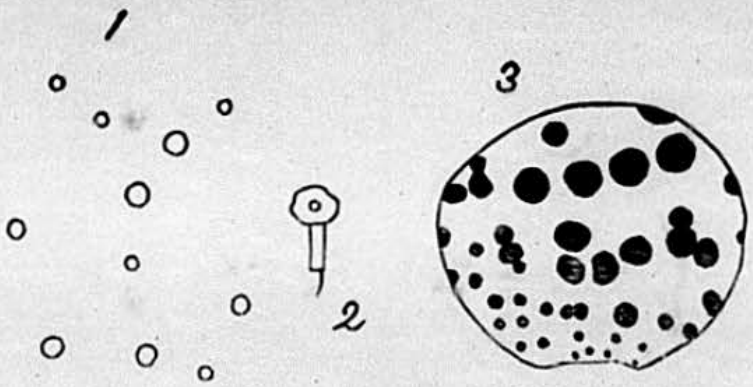
Very common near Hori, always being protected by *Cremastogaster rogenhoferi*. This species is closely related to *L. malaboda* Green, but is different from it in the following characters: (1) Test more strongly convex, white, with no processes. (2) Anal ring with 9 or 10 long setae which are narrowed on the apical portion. (3) Legs not recognizable. (4) Cribriform plates fewer, with pits in a group. (5) Median dorsal plate widely sinuated on the posterior margin. (6) Ventral chitinized plate of anal cleft different in shape.

This species is easily distinguishable from *L. quercus* Ckll. by the shape and colour of the test.

Subfamily Dactylopiinae.

Kermes formosanus sp. nov.

(Adult female) Yellowish brown or dark yellowish brown, with many mostly circular black markings scattered over the whole surface except on the basal side attached to the host; these markings large, some on the upper portion united, but very small, well separated from each other near the base. Body almost globular, smooth on the surface, without wax and setae. Antennae small, rather stout, tapering, 7-jointed, with a few setae; basal 2 joints wider than long; the 3rd, 4th, 5th and 6th almost as long as wide; the 4th more tapering; the 7th a little longer than wide; the relative length of joints about as follows: I—5, II—5, III—7,



(Adult female)

(1).....Pores on dorsum.
(2).....Tubular duct.
(3).....Lateral view.

IV—7, V—4, VI—4, VII—7. Spiracles stout, widely expanded at the outer end, with no pores, but with many very small circular multilocular pores around them. Legs tapering, with scarce setae; coxae large; femora with a slight constriction about the middle, a little longer than wide; tibiae and tarsi not well defined. Derm not reticulated, with many small almost circular pores of somewhat variable size sparsely scattered over the upper portion of body and numerous much larger similar ones intermixed with more numerous short tubular ducts on the basal portion, these ducts fairly numerous along the base of body where circular pores are absent.

Length of body—about 7-8 mm. Antenna—about 0.17537 mm.

Spiracle—about 0.253825 mm. Hind coxa—about 0.14 mm.

Hind trochanter and femur—about 0.13 mm. Hind tibiotarsus—about 0.23075 mm.

Tubular duct—about 0.023 mm.

Host.—*Quercus* sp. (Cupuliferae).

Hab.—Tattaka (altitude more than 7000 feet).

Some specimens killed by a parasite were collected by me on May 19 1924. The specimens are not complete and I can not prepare more detailed description, but the characters above mentioned are not identical with other species of *Kermes* known to me. The genus *Kermes* is new to Formosa.

The black markings on the body become dusky, showing rather faint reticulations, as treated with potash.

Subfamily Coccinae.

Coccus hesperidum L.

Fernald, Cat. Cocc. World, p. 168 (1903); Sanders, Jl. Econ. Ent., ii, p. 436 (1903); Dietz and Morrison, Cocc. Indiana, p. 245 (1916); Leonardi, Mon. Cocc. Ital., p. 319 (1920); Takahashi, Philippine Jl. Sc., xxxvi, 341 (1928).

Lecanium hesperidum, Newstead, Mon. Br. Cocc., ii, p. 78 (1902); Thro, Cornell Univ. Agr. Expt. St., Bull. 209 and 211 (1903); Green, Cocc. Ceylon, p. 188 (1904); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 13 (1917); Brain, Bull. Ent. Res., xi, p. 3 (1923).

Lecanium signiferum, Green, Cocc. Ceylon, p. 197 (1904).

Hosts—*Agave rigida* (Amaryllideae), *Agave* sp., *Areca oleracea* (Palmae), *Baukinia alba* (Leguminosae), *Callicarpa formosana* (Verbenaceae), *Calophyllum*

inophyllum (Guttiferae), *Carica papaya* (Passiflorae), *Citrus* spp. (Rutaceae), *Cocos nucifera* (Palmae), *Ehretia* sp. (Boragineae), *Eriobotrya japonica* (Rosaceae), *Euphoria longana* (Sapindaceae), *Gardenia florida* (Rubiaceae), *Glochidion eryocarpum* (Euphorbiaceae), *G.* sp., *Mallotus philippinensis* (Euphorbiaceae), *Mangifera indica* (Anacardiaceae), *Michelia alba* (Magnoliaceae), *Milletia nitida* (Leguminosae), *Rhodea japonica* (Liliaceae), *Rhus vernicifera* (Anacardiaceae) *Terminalia catappa* (Combretaceae), *Terminalia chebula*, *Thea chinensis* (Ternstroemiaceae).

Hab.—Keelung, Taihoku, Sekitei, Shinten, Giran, Sankyo, Heitin, Nisui, Gyochi, Hori, Shoka, Kagi, Tainan, Hozan, Kuraru.

This species is very common in Formosa, at times occurring in large numbers, but its ravage is not extensive, and is usually protected by *Cremastogaster*. This coccid is sometimes found on *Citrus*, but usually in small numbers.

Coccus punctuliferus Green.

Lecanium punctuliferum, Green, Cocc. Ceylon, iii, p. 205 (1904).

Host.—*Michelia longifolia* (Magnoliaceae), attacking the lower side of the leaf.

Hab.—Gojo.

A few females were collected by me in Septmber 1928. Hitherto unrecorded from Formosa.

Coccus viridis Green.

Fernald, Cat. Cocc. World, p. 174 (1903); Morrison, Philippine Jl. Sc., xvii, p. 190 (1920); Takahashi, Philippine Jl. Sc., xxxvi, p. 341 (1928).

Lecanium viride, Green, Cocc. Ceylon, p. 199 (1904); Lefroy, Mem. Dept. Agr. Ind., ii, p. 130 (1908); Coleman and Kanman, Dept. Agr. Mysore St., Ent. Ser., Bull. 4, p. 4 (1918).

Hosts.—*Achras sapota* (Sapotaceae), *Aegle marmelos* (Rutaceae), *Carissa carandas* (Apocynaceae), *Citrus* sp. (Rutaceae), *Clausena lunulata* (Rutaceae), *Coffea arabica* (Rubiaceae), *Gardenia florida* (Rubiaceae), *Genipa americana* (Rubiaceae), *Heritiera littoralis* (Sterculiaceae), *Ixora chinensis* (Rubiaceae), *Plumeria acutifolia* (Apocynaceae), *Psidium guyava* (Myrtaceae).

Hab.—Kagi, Heito

This species is abundant in the southern part of Formosa in any season, doing serious damage, but is not found in the northern.

Coccus mangiferae Green.

Fernald, Cat. Cocc. World, p. 172 (1903); Morrison, Philippine Jl. Sc., xvii, p. 190 (1920); Takahashi, Philippine Jl. Sc., xxxvi, 341 (1928).

Lecanium mangiferae, Green, Cocc. Ceylon, p. 216 (1904).

Hosts—*Mangifera indica* (Anacardiaceae), *Palaquium formosanum* (Sapotaceae), *Psychotria clyptica* (Rubiaceae).

Hab.—Taihoku, Kagi.

Very scarce, occurring in very restricted numbers.

Coccus acuminatus Signt.

Fernald, Cat. Cocc. World, p. 167 (1903); Takahashi, Philippine Jl. Sc., xxxvi, p. 341 (1928).

Lecanium acuminatus, Green, Cocc. Ceylon, p. 195 (1904).

Host.—*Gardenia florida* (Rubiaceae).

Hab.—Taihoku.

Coccus elongatus Signt.

Fernald, Cat. Cocc. World, p. 168 (1903); Sanders, Jl. Econ. Ent., ii, p. 438 (1909); Dietz and Morrison, Cocc. Indiana, p. 246 (1916); Morrison, Philippine Jl. Sc, xvii, p. 192 (1920); Ferris, Bull. Ent. Res., xii, p. 212 (1921); Takahashi, Philippine Jl. Sc., xxxvi, p. 342 (1928).

Lecanium elongatus, Brain, Bull. Ent. Res., xi, p. 5 (1920).

Coccus longulus, Fernald, Cat. Cocc. World, p. 171 (1903).

Lecanium longulum, Newstead, Mon. Brit. Cocc., ii, p. 86 (1902); Thro, Cornell Univ. Agr. Expt. St., Bull. 209, p. 214 (1903); Green, Cocc. Ceylon, p. 221 (1904); Shiraki, Agr. Expt. St. Formosa, Spec. Rept., 8, p. 73 (1913).

Lecanium (*Coccus*) *longulum*, Pettit and McDaniel, Michigan Agr. Coll. Expt. St., Tech. Bull., 48, p. 17 (1920).

Lecanium frontale, Green, Cocc. Ceylon, p. 192 (1904); Kuwana, Illust. Mon. Cocc. Japan, ii, 16 (1917).

Hosts.—*Acacia confusa* (Leguminosae), *Anona montana* (Anonaceae), *A. squamosa*, *Areca catechu* (Palmae), *Calliandra haematocephala* (Leguminosae), *Calophyllum inophyllum* (Guttiferae), *Casuarina equisetifolia* (Casuarineae), *Citrus* spp. (Rutaceae), *Codiaeum variegatum* (Euphorbiaceae), *Derris laxiflora* (Leguminosae), *Erythroxylon coca* var. *spruceanum* (Linnaceae), *Ficus retusa* (Urtic-

aceae), *Hibiscus rosasinensis* (Malvaceae), *Milletia nitida* (Leguminosae), *Morus alba* (Urticaceae), *Myrica rubra* (Myricaceae) *Nephelium litchi* (Sapindaceae), *Osmanthus fragrans* (Oleaceae), *Pithecolobium dulce* (Leguminosae), *Polyalthia longifolia* (Anonaceae), *Pometia pinnata* (Sapindaceae) *Rhus* sp. (Anacardiaceae), *Vitis vinifera* (Ampelideae).

Hab.—Taihoku, Maruyama, Itahashi, Byoritsu, Dogyu, Shoka, Kagi, Heito, Boryo, Kuraru, Karenko, Tamasato, Botel Tobago.

Very common, sometimes occurring in large numbers.

Coccus caudatus Green.

Fernald, Cat. Cocc. World, p. 168 (1903); Takahashi, Philippine Jl. Sc., xxxvi, p. 341 (1928).

Lecanium caudatum, Green, Cocc. Ceylon, p. 223 (1904).

Host.—Unknown in Formosa.

Hab.—Toyohara.

Coccus acutissimus Green.

Fernald, Cat. Cocc. World, p. 168 (1903); Takahashi, Trans. Nat. Hist. Soc. Formosa, xviii, p. 259 (1928).

Lecanium acutissimum, Cocc. Cyelon, p. 218 (1904).

Hosts.—*Artocarpus integrifolia* (Urticaceae), *Euphoria longana* (Sapindaceae), *Eugenia jambos* (Myrtaceae), *Michelia longifolia* (Magnoliaceae), *M.* sp.

Hab.—Nisui, Suisha, Gyochi, Hori, Kagi, Kuraru.

Common, sometimes occurring in abundance in the southern part. The females are located along the stouter ribs on the lower sides of the leaves.

Coccus bicruciatus Green.

Ferris, Bull. Ent. Res., xii, p. 212 (1921); Takahashi, Philippine Jl. Sc., xxxvi, p. 341 (1928).

Lecanium bicriciatum, Green, Cocc. Ceylon, p. 214 (1904).

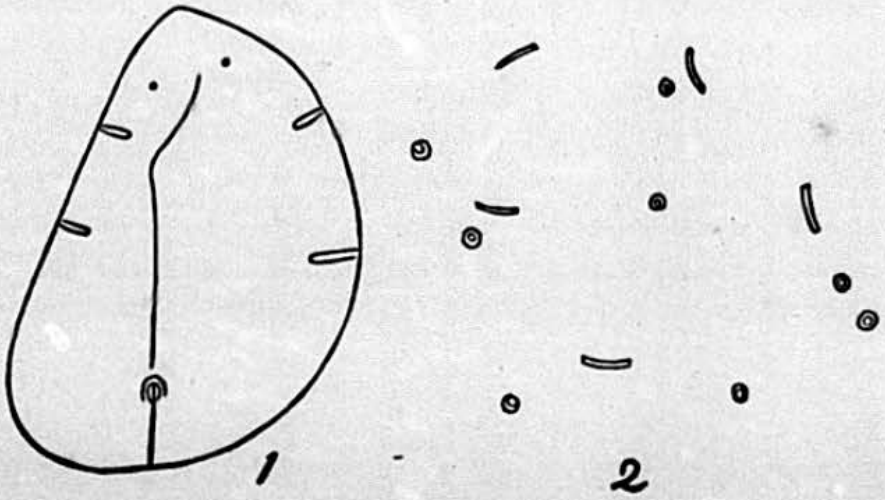
Host.—*Murraya exotica* (Rutaceae).

Hab.—Taihoku.

Neoplatylecanium gen. nov.

(Adult female) Body very flat, without marginal setae, provided with many small pores on the dorsum, not covered with powder. Legs small, as in Coccus

in structure. Antennae small, 6-jointed. Stigmatic clefts very peculiar as shown in the figures. Abdominal segments not defined. Anal plates long, rounded on the outer side, surrounded by a strongly chitinized band. Forming no ovisac.



(Adult female)
(1).....Outline of body.
(2).....Pores and ducts on dorsum.

Genotype.—*Neoplatylecanium cinnamomi* sp. nov.

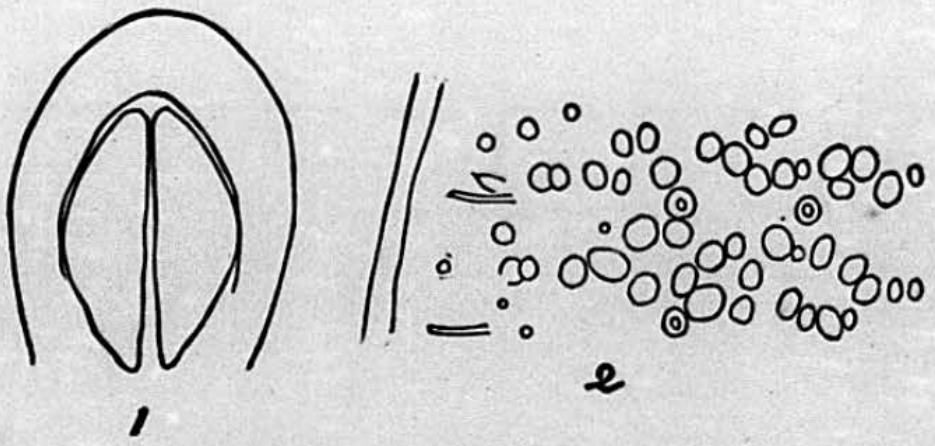
This genus is related to *Coccus*, *Platylecanium* and their allies, but differs from them in the characters of the stigmatic clefts and anal plates, lacking marginal setae, or in the presence of the legs.

Coccus tripartitus Green from Ceylon also belongs to this new genus.

Neoplatylecanium cinnamomi sp. nov.

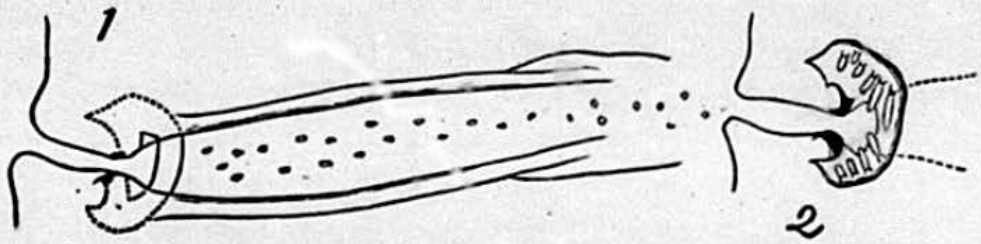
(Adult female) Shining blackish brown. Body very flat, heavily chitinized, asymmetrical, more rounded on one side (almost symmetrical in very few specimens), broadest about the middle, somewhat narrowed on the anterior portion, slightly pointed at the anterior extremity in some specimens, broadly rounded on the posterior extremity; dorsum with a median longitudinal narrow carica which is extending nearly from the eyes to the anal plates, a little curved to the more rounded side of the body on the anterior end, with about 5 very inconspicuous transverse ridges on each side. Eyes more widely separated from each other than from the body margin. Beak small. Antennae short, somewhat tapering, 6-jointed, slightly shorter than the hind femur, tibia and tarsus taken together,

with a few bristles; the 1st joint a little wider than long, stouter than the 2nd; the 2nd almost as long as wide; the 3rd about 2.7 times as long as wide, with a faint trace of division near the distal end; distal 3 joints somewhat longer than wide; with some bristles at the apex; the relative length of joints about as follows: I—8, II—7, III—17, IV—5, V—5, VI—8. Spiracles small, equal in size, almost as long as the hind tarsus, widely expanded on both ends, but somewhat less so on the outer end, slender on the shank, with no pores on the side of orifice; some minute intrasparent pores in a group connecting the spiracle with the cleft; these pores much smaller than the dorsal transparent pore. Legs small, somewhat longer posteriorly; coxae large; femora very slightly swollen, not well defined from the trochanter; tibiae somewhat tapering, not well defined from the tarsus, almost



(1).....Anal plates.
(2).....Marginal area of dorsum.

as long as the tarsus in the front and middle legs; hind femora very slightly swollen, almost as stout as the 3rd antennal joint, nearly thrice as long as wide; hind tibiae slightly longer than the tarsus; hind tarsi with a slight constriction near the apical portion; claws very small, with distictly knobbed digitules which are stouter than the tarsal one. Anal plates long, narrow, rounded on the outer side, rounded on the base, more or less pointed at the apex, about 2.8 times as long as wide, surrounded by a very broad more chitinized band excepting the posterior portion, with scarce setae on the apex. Anal ring small, situated in front of the anal plates, with 8? long stout setae reaching nearly the middle of the anal plate. Stigmatic clefts small, with a heavily chitinized rim, with 8-10 stout spines which are rounded at the apex, somewhat swollen, arranged in 2



(1).....Stigmatic cleft (lower side) (2).....Stigmatic spines.

rows, variable in length, the most inner ones the longest. Body with a very narrow transparent thin rim along the whole margin, lacking hairs on the margin, dorsum and venter. Dorsum with many very small transparent circular pores sparsely scattered over the whole surface, intermixed with very slender tubular ducts which are somewhat curved, almost equal in number to, but much smaller in diameter than, the circular pore; numerous small oval or circular intransparent maculae on the whole marginal area which are much larger than the circular pore; and many small transparent almost circular areolations on the posterior portion behind the anal plates.

Length of body—about 4.8-5.0 mm. Width of body—about 4.0 mm.

Length of carina—about 2.5 mm. Distance between eyes—about 0.8768 mm.

Length of antenna—about 0.23075 mm. Hind coxa—about 0.06923 mm.

Hind trochanter and femur—about 0.115375 mm.

Hind tiba—about 0.06923 mm. Hind tarsus—about 0.06 mm.

Anal plate—about 0.15691 mm. Tubular duct—0.04615 mm.

Stigmatic spine—about 0.013 mm.—0.0323 mm.

Host.—*Cinnamomum ceylanicum*, attacking the upper side of the leaf along the midrib.

Hab.—Kuraru.

Some specimens were collected by me in June 1928.

Eucalymnatus tessellatus Signt.

Fernald, Cat. Cocc. World, p. 166 (1903); Leopardi, Mon. Cocc. Ital., p. 323 (1920); Costa Lima, Arch. Esc. Agr. Med. Veter. Nictheroy, vii, p. 36 (1923); Takahashi, Philippine Jl. Sc., xxxvi, p. 343 (1928).

Lecanium tessellatum, Green, Proc. Linn. Soc. London, ser. 2, xii, p. 200 and 205 (1907); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 27 (1917).

Lecanium perforatum, Newstead, Mon. Brit. Cocc, ii, p. 121 (1902); Thro, Cornell Univ. Agr. Expt. St., Bull. 209, p. 212 (1903).

Eucalymnatus perforatum, Fernald, Cat. Cocc. World, p. 166 (1903).

Lecanium tessellatum var. *perforatum*, Green, Cocc. Ceylon, p. 207 (1904).

Lecanium subtessellatum, Green, Cocc. Ceylon, p. 206 (1904).

Hosts—*Aglaia formosana* (Meliaceae), *Calophyllum inophyllum* (Guttiferae), *Cinnamomum ceylanicum* (Laurineae), *Cocos nucifera* (Palmae), *Euphoria longana* (Sapindaceae), *Ficus elastica* (Urticaceae), *Heritiera littoralis* (Sterculiaceae), *Machilus* sp. (Laurineae), *Mangifera indica* (Anacardiaceae), *Palaquium formosanum* (Sapotaceae).

Hab.—Taihoku, Taichu, Nisui, Rengechi, Suisha, Takezaki, Kagi, Shoka, Kurarn.

This species is very common in the southern part of the island, occurring, however, in small numbers, though it is very scarce in the northern.

Paralecanium expansum Green.

Fernald, Cat. Cocc. World, p. 199 (1903); Takahashi, Philippine Jl. Sc., xxxvi, p. 343 (1928).

Lecanium (*Paralecanium*) *expansum*, Green, Cocc. Ceylon, p. 235 (1904).

Hosts.—*Ficus retusa* (Urticaceae), *Machilus* sp. (Laurineae), *Myrica rubra* (Myricaceae).

Hab.—Taihoku, Shirin.

Saissetia nigra Nietn.

Fernald, Cat. Cocc. World, p. 204 (1903); Sanders, Jl. Econ. Ent., ii, p. 440 (1909); Brain, Bull. Ent. Res., xi, p. 10 (1920); Morrison, Philippine Jl. Sc., xvii, p. 197 (1920); Takahashi, Philippine Jl. Sc., xxxvi, p. 342 (1928).

Lecanium nigrum, Newstead, Mon. Brit. Cocc., ii, p. 124 (1902); Green, Cocc. Ceylon, p. 229 (1904).

Hosts—*Ardisia quinquegona* (Myrsineae), *Areca catechu* (Palmae), *Artemisia capillaris* (Compositae), *Bischoffia javanica* (Euphorbiaceae), *Calophyllum inophyllum* (Guttiferae), *Canna indica* (Scitamineae), *Chrysophyllum cainito* (Sapotaceae), *Citrus* spp. (Rutaceae), *Codiaeum variegatum* (Euphorbiaceae), *Eugenia javanica* (Myrtaceae), *Ficus carica* (Urticaceae), *F. elastica*, *F. gibbosa*, *F. retusa*, *F.* sp., *F. wightiana*, *Gossypium herbaceum* (Malvaceae), *Glochidion* sp.

(Euphorbiaceae), *Morus alba* (Urticaceae), *Musa sapientum* (Scitamineae), *Plumeria acutifolia* (Apocynaceae), *Psidium guyava* (Myrtaceae), *Pirus* sp. (Rosaceae), *Salix warburgii* (Salicineae), *Sapium sebiferum* (Euphorbiaceae), *Terminalia catappa* (Combretaceae), a plant of the Leguminosae.

Hab.—Tansui, Shirin, Taihoku, Girar, Rinnai, Shoka, Nisui, Takeyama, Dogyu, Hori, Tainan, Kagi, Takao, Heito, Karenko, Taito, Botel Tobago.

This species is very common, but is usually found in small numbers. A heavy infestation, however, was observed on a large tree of *Glochidion* at Takeyama in April 1928.

Saissetia oleae Bern.

Fernald, Cat. Cocc. World, p. 205 (1903); Sanders, Jl. Econ. Ent., ii, p. 440 (1909); Dietz and Morrison, Cocc. Indiana, p. 259 (1916); Brain, Bull. Ent. Res., xi, p. 10 (1920); Morrison, Philippine Jl. Sc., xvii, p. 197 (1920); Leonardi, Mon. Cocc. Ital., p. 278 (1920); Takahashi, Philippine Jl. Sc., xxxvi, p. 343 (1928).

Lecanium oleae, Newstead, Mon. Brit. Cocc., ii, p. 126 (1902); Thro, Cornell Univ. Agr. Expt. St, Bull. 209 p. 214 (1903); Green, Cocc. Ceylon, p. 227 (1904); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 6 (1917).

Lecanium (*Saissetia*) *oleae*, Pettit and McDaniel, Michigan Agr. Coll. Expt. St., Tech. Bull. 48, p. 19 (1920).

Hosts—*Calophyllum inphyllum* (Guttiferae), *Euphoria longana* (Sapindaceae), *Gardenia florida* (Rubiaceae), *Gossypium herbaceum* (Malvaceae), *Nerium odorum* (Apocynaceae), *Tectona grandis* (Verbenaceae), *Terminalia catappa* (Combretaceae).

Hab.—Taihoku, Shoka, Hori, Kagi, Kurara.

In Formosa this species is extremely scarce, occurring in very restricted numbers, and is not found on *Citrus*. This rarity may be explained by the presence of a Chalcid parasite which has not been identified. This coccid is sometimes protected by *Cremastogaster*.

Saissetia formicarii Green.

Fernald, Cat. Cocc. World, p. 202 (1903); Takahashi, Philippine Jl. Sc., xxxvi, p. 343 (1928).

Lecanium formicarii, Green, Cocc. Ceylon, p. 190 (1904).

Hosts.—*Aegle sepiaria* (Rutaceae), *Aglaia odorata* (Meliaceae), *Ardisia*

sieboldii (Myrsineae), *Areca oleracea* (Palmae), *Artocarpus integrifolia* (Urticaceae), *Bischoffia javanica* (Euphorbiaceae), *Callicarpa formosana* (Verbenaceae), *Cinnamomum camphora* (Lauineae), *C. camphora nominale*, *C. ceylanicum*, *Diospyros kaki* (Ebenaceae), *D. discolor*, *Eriodendron anfractuosum* (Malvaceae), *Eucalyptus* sp. (Myrtaceae), *Eugenia javanica* (Myrtaceae), *Evodia triphylla* (Rutaceae), *Ficus leucantatoma* (Urticaceae), *F. vasculosa*, *F. wightiana*, *F.* sp., *Garcinia spicata* (Guttiferae), *Gardenia florida* (Rubiaceae), *Gordonia axillaris* (Ternstroemiaceae), *Grevillea robusta* (Proteaceae), *Heptapleurum octophyllum* (Araliaceae), *Kentia macarthurii* (Palmae), *Lagerstroemia flos-reginae* (Lythrariaceae), *Lithocarpus* sp. (Cupuliferae), *Machilus* sp. (Laurineae), *Mangifera indica* (Anacardiaceae), *Michelia alba* (Magnoliaceae), *Michelia* sp., *Myristica heterophylla* (Myristiceae), *Olea europea* (Oleaceae), *Palaquium formosanum* (Sapotaceae), *Persea gratissima* (Laurineae), *Prunus* sp. (Rosaceae), *Psidium guyava* (Myrtaceae), *Rhus vernicifera* (Anacardiaceae) *Salix* sp. (Salicineae), *Sapium sebiferum* (Euphorbiaceae), *Schima noronhae* (Ternstroemiaceae), *Thea chinensis* (Ternstroemiaceae), *T. japonica*.

Hab.—Taihoku, Shinten, Shirin, Maruyama, Sekitei, Shoka, Gyochi, Gojo, Suisha, Hori, Takeyama, Kagi, Kanshirei, Kuraru.

This species is very common throughout the lowlands of Formosa, often occurring in large numbers. The colonies are always inclosed in the nests or tents of *Cremastogaster rogenhoferi*. I collected *Encyrtus barbatus* Timb.* parasitizing this coccid in a tent of this ant at Kagi, in November 1927.

Saissetia hemisphaerica Targ.

Fernald, Cat. Cocc. World, p. 202 (1903); Sanders, Jl. Econ. Ent., ii, p. 439 (1909); Essig, Pomona Coll. Jl. Ent., ii, p. 216 (1910); Dietz and Morrison, Cocc. Indiana, p. 260 (1916); Coleman and Kannan, Dept. Agr. Mysore St., Ent. Ser., Bull. 4, p. 55 (1918); Brain, Bull. Ent. Res., xi, p. 9 (1920); Morrison, Philippine Jl. Sc., xvii, p. 196 (1920); Leonardi, Mon. Cocc. Ital., p. 281 (1920); Ferris, Bull. Ent. Res., xii, p. 212 (1921); Takahashi, Philippine Jl. Sc., xxxvi, p. 342 (1928).

Lecanium hemisphaericum, Newstead, Mon. Brit. Cocc., ii, p. 113 (1902); Thro, Cornell Univ. Agr. Expt. St., Bull. 209, p. 215 (1903); Green, Cocc. Ceylon, p. 232 (1904); Shiraki, Agr. Expt. St. Formosa, Spec. Rept., 8, p. 85

* Identified by Mr. T. Ishii.

(1913); Maki, Forest Expt. St. Formosa, Spec. Rept., 1, p. 27 (1915); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 3 (1917).

Lecanium (*Saissetia*) *hemisphaericum*, Pettit and McDaniel, Michigan Agr. Coll. Expt. St., Tech. Bull. 48, p. 20 (1920).

Hosts—*Aliantum concatum* (Polypodiaceae), *A.* sp., *Agina globosa* (Caryophulanaceae), *Anona* sp. (Anonaceae), *Ardisia crispa* (Myrsineae), *A. quinquegona*, *Bischoffia javanica* (Euphorbiaceae), *Calanthe* sp. (Orchideae), *Carissa carandas* (Apocynaceae), *Chrysophyllum cainito* (Sapotaceae), *Cinchona* sp. (Rubiaceae), *Citrus* spp. (Rutaceae), *Coffea arabica* (Rubiaceae), *Cucurbita moschata* (Cucurbiaceae), *Cunninghamia lanceolata* (Coniferae), *Cycas revoluta* (Cycadaceae), *Diospyros discolor* (Ebenaceae), *Eugenia unifolia* (Myrtaceae), *Ficus wightiana* (Urticaceae), *Garcinia spicata* (Guttiferae), *Gardenia florida* (Rubiaceae), *Ixora chinensis* (Rubiaceae), *Lagerstroemia indica* (Lythrarieae), *Machilus* sp. (Laurineae), *Mangifera indica* (Anacardiaceae), *Osmanthus fragrans* (Oleaceae), *Plumeria acutifolia* (Apocynaceae), *Psidium guyava* (Myrtaceae), *Psychotria elliptica* (Rubiaceae), *Rhus vernicifera* (Anacardiaceae), *R.* sp., *Tabernaemontana* sp. (Apocynaceae), *Thea chinensis* (Ternstroemiaceae).

Hab.—Tansui, Giran, Taihoku, Urai, Itahashi, Heitin, Kori, Shoka, Suisha, Rengechi, Hori, Takeyama, Kagi, Takezaki, Funkiko (altitude about 4600 feet) on Mt. Ari, Koheki, Kanshirei, Shinka, Heito, Koshun, Kuraru, Taito, Chippon, Botel Tobago.

This species is very abundant in Formosa, but rarely occurs in large numbers on *Citrus*. Sometimes protected by *Cremastogaster rogenhoferi*.

This insect ranks next to the foregoing species in the degree of abundance among the species of *Saissetia* in Formosa.

Pulvinaria psidii Mask.

Fernald, Cat. Cocc. World, p. 137 (1903); Green, Cocc. Ceylon, p. 264 (1909); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 33 (1917); Coleman and Kannan, Dept. Agr. Mysore St., Ent. Ser., Bull. 4, p. 62 (1918); Morrison, Philippine Jl. Sc., xvii, p. 185 (1920); Brain, Bull. Ent. Res., xi, p. 21 (1920); Takahashi, Philippine Jl. Sc., xxxvi, 344 (1928).

Hosts.—*Artocarpus integrifolia* (Urticaceae), *Chrysophyllum cainito* (Sapotaceae), *Citrus* sp. (Rutaceae), *Coffea arabica* (Rubiaceae), *Euphoria longana* (Sapindaceae), *Gardenia florida* (Rubiaceae), *Mangifera indica* (Anacardiaceae),

Psidium guyava (Myrtaceae), *Psychotria elliptica* (Rubiaceae).

Hab.—Hokuto, Taihoku, Kagi.

This species is very common, occurring in abundance, but on *Citrus* I have observed only a female in January. *Microterys* sp. parasitizes this coccid.

Pulvinaria polygonata Ckll.

Proc. Davenport Acad. Sc., x, p. 131 (1905); Morrison, Philippine Jl. Sc., xvii, p. 184 (1920); Takahashi, Philippine Jl. Sc., xxxvi, p. 344 (1928).

Pulvinaria cellulosa, Green, Cocc. Ceylon, p. 262 (1909).

Orthezia insignis, Shiraki (nec. Dougl.), Agr. Expt. St. Formosa, Spec. Rept, 8, p. 104 (1913); Nitobe, Rept. Stud. Citrus Ins. Formosa, p. 44 (1916).

Pulvinaria aurantii, Maki (in part) (nec Ckll.), Forest Expt. St. Formosa, Spec. Rept., 1, p. 24 (1915); Nitobe, Rept. Stud. Citrus Ins. Formosa, p. 51 (1916).

Hosts—*Citrus* spp. (Rutaceae), *Murraya exotica* (Rutaceae).

Hab.—Taihoku, Kagi, Heito, Shinchiku.

The immature forms on *Murraya exotica* are sometimes protected by *Cremastogaster rogenhoferi* and this species is also sometimes visited by *Plagiolepis longipes*. This species is rather commonly parasitized by *Aneristus ceroplastae* Howard* in Formosa.

Pulvinaria thespesiae Green.

Cocc. Ceylon, p. 259 (1909); Morrison, Philippine Jl. Sc., xvii, p. 183 (1920); Takahashi, Philippine Jl. Sc., xxxvi, p. 344 (1928).

Host.—*Morus acidosa* (Urticaceae).

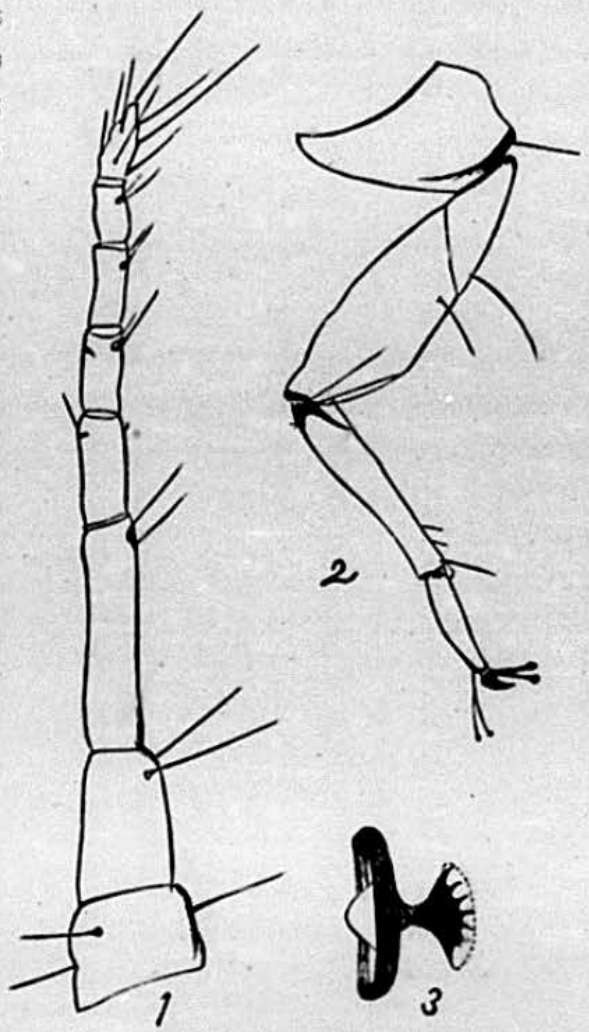
Hab.—Hakumo.

Pulvinaria taiwana sp. nov.

(Adult female) In dried specimens, yellowish brown, blackish on the dorsum excepting the marginal area, body somewhat wrinkled, not shining, somewhat covered with powder. Body almost circular, not strongly chitinized, very slightly longer than wide, flat, somewhat convex on the dorsum, broadly rounded on both ends. Antennae as widely separated from each other as from the body margin, a little shorter than the front leg, 8-jointed, with a few long bristles,

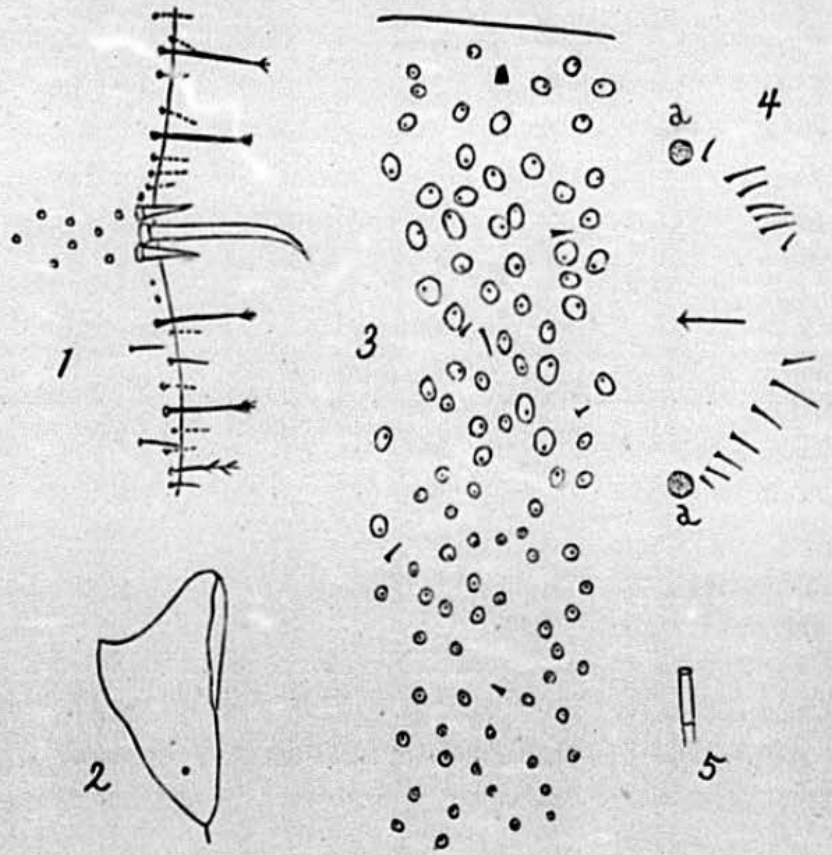
* Identified by Mr. T. Ishii.

of which those on the basal 2 joints are stouter and longer; the 1st joint wider than long; the 2nd moderately tapering, about 1.7 times as long as wide, one of the bristles much longer, almost as long as or longer than the joint itself; the 3rd cylindrical, about 4 times as long as wide; the 4th and 5th about twice as long as wide; the 6th and 7th longer than wide; the 8th about thrice as long as wide, with some very long bristles, one of which is much longer, longer than the joint itself; the relative length of joints about as follows: I—14, II—26, III—35, IV—16, V—16, VI—10, VII—11, VIII—14. Eyes unrecognizable. Beak very stout, almost straight on the distal end. Legs rather short, with a few bristles; front legs slightly shorter; femora stout, very slightly swollen, about 2.5 times as long as wide, slightly longer than the tibia; tibiae slightly dilated on the basal portion, about twice as long as the tarsus, wanting pores; tarsi slightly curved, about thrice as long as wide, with very long digitules which are knobbed, shorter than the tarsus itself; claws without denticles, with very stout digitules. Stigmatic clefts very shallow, with 3 pointed spines, of which one is much longer, twice or thrice as long as, but almost as stout as, the shorter spine, curved on the distal portion, reaching beyond the body margin; shorter spines conical, about 4 times as long as wide, straight, more pointed at the tip than the longer one, shorter than the marginal seta. Boyd margin with stiff setae variable



(Adult female)
(1).....Antenna.
(2).....Front leg.
(3).....Spiracle.

in length, not arranged in a single row; the longer ones arranged in a row, mostly with very short branches at the tip, somewhat shorter than the longer stigmatic spine, those on the posterior end not branched at the tip About 20 minute conical blunt tubercles present along the whole body margin. Spiracles enqual in size, very widely expanded at the distal end,



(Adult female)
(1).....Stigmatic spines and marginal setae.
(2).....Anal plate.
(3).....Pores and setae on dorsum.
(4).....Setae between antenna
a.....Base of antenna.
Arrow indicates the direction of front.
(5).....Ventral duct.

rather slender on the middle portion, widely separated from the body margin, almost as long as the 2nd antennal joint, without pores on the side of the orifice; many minute circular pores connecting the speracle with the body margin. Anal cleft moderate in length. Anal plates rather stout, rounded on the basal end, less so on the tip, with a few bristles on the apical part; the basal margin almost as long as the outer. Anal ring rather small, with about 10 stout bristles reaching the middle of the anal plate. Dorsum with very few minute setae and numerous very small circular or oval transparent pores scattered over the whole surface, these pores much larger on the whole marginal area, elongated near the anal plates. Venter with numerous short tubular ducts scattered almost

over the whole surface except on the genital area, which are as long as the dorsal seta; many very small circular multilocular pores present in a ∩-shaped group on the genital area and in 4 transverse short rows in front of the genital group; these pores larger in diameter than the tubular duct, much fewer in the front 2 rows. About 14 long bristles arranged in a v-shaped row between the antennae, which are variable in length, the longer ones a little longer than the 3rd antennal joint; 3 pairs of very long bristles present on the venter in front of the anal plates.

Length od body—about 7.0-8.0 mm. Width of body—about 5.0-7.0 mm.

Length of antenna—about 0.6-0.69 mm.

Distance between antennae—about 1.2-1.4 mm.

Length of anal cleft—about 1.0 mm. Anal plate—about 0.19 mm.

Distance between posterior spiracle and body margin—about 0.95 mm. in an instance. Length of longer marginal seta—about 0.06 mm. Longer stigmatic spine—about 0.0692 mm.

Shorter stigmatic spine—about 0.037 mm. Hind femur—about 0.30 mm.

Hind tibia—about 0.26 mm. Hind tarsus—about 0.14 mm.

Dorsal seta—about 0.022 mm. Tubular duct—about 0.0185 mm.

Diameter of largest dorsal pore—about 0.046 mm. Longest seta between antennae—about 0.20767 mm.

Host.— *Mangifera indica* (Anacardiaceae), attacking the branch.

Hab.—Kagi.

Some specimens were collected by Mr. K. Toyota in January and December. This species is very closely related to *Pulvinaria idesiae* Kuwana, but is different from it in the characters of the marginal setae.

Eriochiton theae Green.

Ind. Mus. Not., v, p. 10 (1900).

Host.—*Thea chinensis* (Ternstroemiaceae).

Hab.—Heitin.

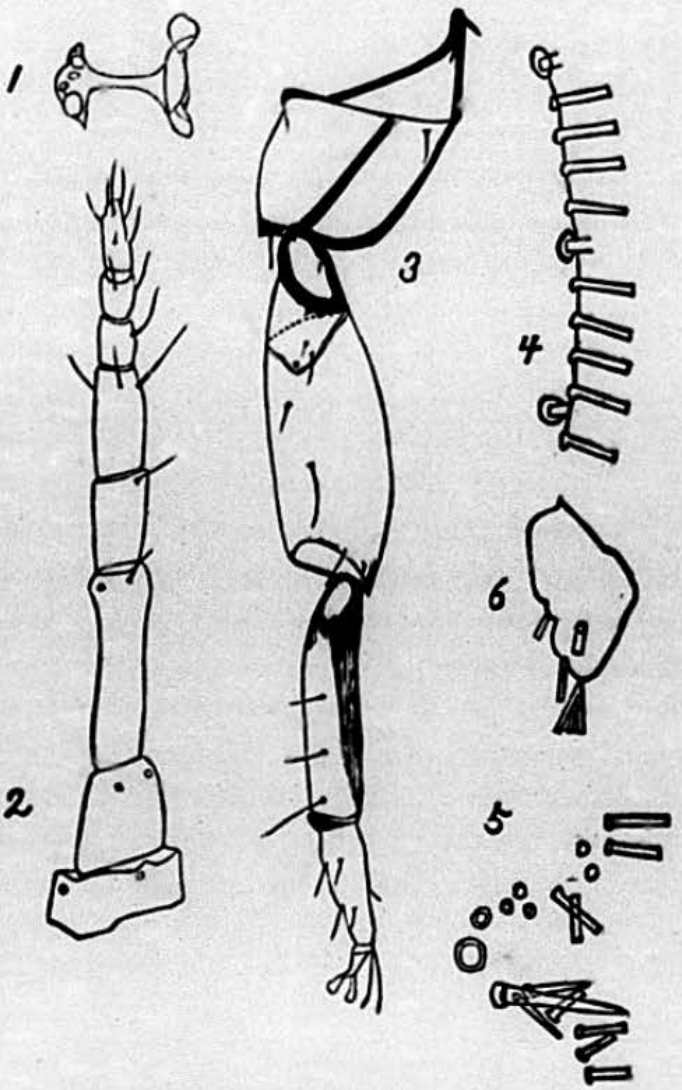
Hitherto unrecorded from Formosa. This species sometimes occurs in large numbers on the leaves and branches. Collected by Mr. J. Sonan.

Eriochiton formosae sp. nov.

(Adult female) Test white, completely covering the body, oblong oval,

rather strongly convex, compact.

Body yellowish brown, flat, oval, about 1.6 times as long as wide in mounted specimens. Front margin as broadly rounded as the posterior margin. Antennae 8-jointed, with some bristles; the 1st joint very short, much wider than long; the 2nd almost as long as wide; the 3rd cylindrical, somewhat dilated on the distal portion, about thrice as long as wide; the 4th very slightly narrowed towards the base, a little longer than wide; the 5th about twice as long as wide; the 6th somewhat longer than wide; the 7th as long as wide; the 8th more than twice as long as wide, with some long bristles; the relative length of joints about as follows: I—7, II—14, III—25, IV—12, V—14, VI—7, VII—5, VIII—9. Beak very short, stout, not pointed, wider than long. Spiracles somewhat larger in the posterior pair, very widely expanded on the outer end, less so on the base, lacking pores on the side of the orifice, with some large areolations on the base, almost as long as the front tarsus; shanks very slender. Legs rather



(Adult female)
(1).....Spiracle.
(2).....Antenna.
(3).....Hind leg.
(4).....Spines on front margin (larger spines broken off).
(5).....Stigmatic cleft (some spines broken off).
(Matured larva of female)
(6).....Anal plate.

stout, with a few bristles; femora very stout, slightly swollen, not well defined from trochanters; hind femora somewhat longer than the tibia, slightly more than twice as long as wide; hind tibiae about 4 times as long as wide, about twice as long as the tarsus; tarsi somewhat tapering, with a strongly chitinized part at the base; hind tarsi almost thrice as long as wide; tarsal digitules very long, somewhat dilated on the distal portion; claws with stout capitate digitules, but no denticles. Marginal setae regularly arranged in a single row, of 2 types; the smaller ones present along the whole margin, stout, truncate, about 6 times as long as wide, not curved, not expanded at the base, scarcely tapering, equal in length, slightly shorter than the last antennal joint; the longer ones much fewer, stouter, present only on the anterior and posterior margins, about 33 in number in all. Stigmatic clefts distinct, with about 6 or 7 more or less pointed spines, of which 2 or 3 are longer; the shorter ones as long as or somewhat longer than, but slightly more slender than, the shorter marginal seta; the longer ones stouter, sometimes slightly curved on the distal portion, reaching the body margin. Numerous very small circular pores connecting the spiracle with the body margin. Anal cleft rather short. Anal plates stout, blunt at the apex, with 3 truncate setae which are almost as long as, but more slender than, the shorter marginal seta, and a dilated flattened seta at the tip; the inner margin longest, not straight; the basal margin somewhat longer than the outer. Dorsum with some minute sharply pointed, slender conical spines sparsely scattered over the whole surface. Venter with numerous very small circular pores on the genital area and numerous very short tubular ducts over the whole surface, which are much shorter on the posterior portion, shorter than the dorsal spine; 2 pairs of long bristles present on the posterior part of the venter, the anterior pair somewhat shorter, almost as long as the hind tarsus; similar 4 bristles present between the antennae.

Length of body—about 2 7 mm. Antenna—about 0.45 mm.
Hind femur—about 0.20767 mm. Hind tibia—about 0.1846 mm.
Hind tarsus—about 0.0923 mm. Anal plate—about 0.17537 mm.
Shorter marginal seta—about 0.034 mm.
Longest stigmatic spine—about 0.08307 mm. Hind tarsal digitule—about 0.07384 mm.

Host.—Unknown.

Hab.—Taito.

A few specimens were collected by Mr. S. Akasaka in December 1927. This species differs from all other species of the genus in possessing a flattened seta on the anal plate. Some of my specimens have been examined by Mr. E. E. Green.

Lecanopsis sacchari Takah.

Philippine Jl. Sc., xxxvi, p. 345 (1928).

Hosts.—*Miscanthus* sp. (Gramineae), *Saccharum officinarum* (Gramineae), a plant of the Gramineae.

Hab.—Taichu, Kori.

This species is common in Kori, attacking the roots, and is attended by an ant, at times becoming a serious pest of sugar cane.

Ceroplastes rubens Mask.

Fernald, Cat. Cocc. World, p. 156 (1903); Green, Cocc. Ceylon, p. 273 (1909); Kuwana, Illust. Mon. Coc. Japan, ii, p. 65 (1917); Morrison, Philippine Jl. Sc., xvii, p. 188 (1920); Ferris, Bull. Ent. Res., xii, p. 212 (1921); Kuwana, Dept. Agr. Com., Imp. Plant Quar. St., Bull. 3, p. 18 (1923) and Byokin Gaichu Iho (Dept. Agr. and Forest), no 10, p. 35 (1923); Takahashi, Philippine Jl. Sc., xxxvi, p. 345 (1928).

Hosts.—*Calophyllum inophyllum* (Guttiferae), *Cinnamomum ceylanicum* (Laurineae), *Citrus* spp. (Rutaceae), *Eugenia jambos* (Myrtaceae), *Euphoria longana* (Sapindaceae), *Garcinia spicata* (Guttiferae), *Mangifera indica* (Anacardiaceae), *Myristica heterophylla* (Myristiceae), *Palaquium formosanum* (Sapotaceae), *Persea gratissima* (Laurineae).

Hab.—Taihoku, Shinten, Shimpo, Shoka, Takeyama, Gyochi, Suisha, Rengechi, Nisui, Kagi, Heito, Kurarn.

This species is rather common in the southern part of the island, occurring, however, in very small numbers and being especially scarce on *Citrus*, but is extremely rare in the northern. It is found usually on the upper sides of the leaves on or along the stout ribs in Formosa, though it is abundant on the branches of *Citrus* in Japan proper.

Ceroplastes floridensis Comst.

Fernald, Cat. Cocc. World, p. 152 (1903); Comstock, Cornell Univ. Agr.

Expt. St., N. Y. St. Coll. Agr., Bull. 372, p. 480 (1916); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 77 (1917) and Dept. Agr. Com., Imp. Plant Quar. St., Bull. 3, p. 34 (1923); Takahashi, Philippine Jl. Sc., xxxvi, p. 345 (1928).

Hosts.—*Artocarpus* sp. (Urticaceae), *Calophyllum inophyllum* (Guttiferae), *Carissa carandas* (Apocynaceae), *Citrus* spp. (Rutaceae), *Diospyros discolor* (Ebenaceae), *Eriobotrya japonica* (Rosaceae), *Gardenia florida* (Rubiaceae), *Machilus* sp. (Laurineae), *Maesa sinensis* (Myrsineae), *Mangifera indica* (Anacardiaceae), *Poncirus trifoliata* (Rutaceae), *Psidium guyava* (Myrtaceae), *Psychotria elliptica* (Rubiaceae), *Rhodomyrtus tomentosa* (Myrtaceae), *Schima confertiflora* (Ternstroemiaceae), *Ternstroemia japonica* (Ternstroemiaceae), *Thea chinensis* (Ternstroemiaceae).

Hab.—Taihoku, Maruyama, Giran, Shimpo, Tsusho, Jukirin, Hori, Kagi, Kuraru.

In Formosa this species is of common occurrence, but is very few.

Ceroplastes ceriferus And.

Fernald, Cat. Cocc. World, p. 149 (1903); Green, Cocc. Ceylon, p. 270 (1909); Shiraki, Agr. Expt. St. Formosa, Spec. Rept., 8, p. 83 (1913); Maki, Rept. Stud. Mulberry Ins., p. 50 (1916); Kuwana, Illust. Mon. Cocc. Japan, ii, p. 70 (1917); Morrison, Philippine Jl. Sc., xvii, p. 188 (1920); Kuwana, Dept. Agr. Com., Imp. Plant. Quar. St., Bull. 3, p. 43 (1923); Takahashi, Philippine Jl. Sc., xxxvi, p. 345 (1928).

Hosts.—*Artemisia capillaris* (Compositae), *Citrus* spp. (Rutaceae), *Ficus retusa* (Urticaceae), *Ixora chinensis* (Rubiaceae), *Mangifera indica* (Anacardiaceae), *Melastoma candidum* (Melastomaceae), *Morus alba* (Urticaceae), *Persea gratissima* (Laurineae), *Polygonum chinense* (Polygonaceae), *Pometia pinnata* (Sapindaceae), *Pygeum preslii* (Rosaceae), *Rhodomyrtus tomentosa* (Myrtaceae), *Thea chinensis* (Ternstroemiaceae).

Hab.—Tansui, Taihoku, Kinpori, Sozan, Shinchiku, Kagi, Kuraru, Botel Tobago.

This species is more scarce than *C. floridensis* Comst.

Ceroplastodes chiton Green.

Cocc. Ceylon, p. 287 (1909); Takahashi, Philippine Jl. Sc., xxxvi, p. 345 (1928).

Host.—*Ficus retusa* (Urticaceae), attacking the air root.

Hab.—Keelung, Tansui, Taihoku, Maruyama.

Vinsonia stellifera Westw.

Fernald, Cat. Cocc. World, p. 159 (1903); Green, Cocc. Ceylon, p. 280 (1909); Morrison, Philippine Jl. Sc., xvii, p. 187 (1920).

Hosts.—*Garcinia spicata* (Guttiferae), *Mangifera indica* (Anacardiaceae).

Hab.—Kurarn.

A few females were taken by me on June 28, 1928.

Hitherto unrecorded from Formosa.

Subfamily Lacciferinae.

Tachardina theae Green et Mann.

Tachardina decorella var. theae, Green and Mann, Mem. Dept. Agr. Ind., Ent. Ser., i, p. 348 (1907) and ii, p. 28 (1908).

Tachardina theae, Chamberlin, Bull. Ent. Res., xiv, p. 210 (1923); Takahashi, Philippine Jl. Sc., xxxvi, p. 347 (1928).

Tachardina decorella, Ferris, Bull. Ent. Res., xii, p. 212 (1921).

Kermes sp., Maki, Forest Expt. St. Formosa, Spec. Rept., 1, p. 30 (1915).

Hosts.—*Ardisia sieboldi* (Myrsineae), *Ficus retusa* (Urticaceae), *Machilus* sp. (Laurineae), *Michelia compressa* (Magnoliaceae), *M. fuscata*, *M. longifolia*, *Myrica rubra* (Myricaceae), *Thea chinensis* (Ternstroemiaceae), *Rhodomyrtus tomentosa* (Myrtaceae), *Schima* sp. (Ternstroemiaceae).

Hab.—Taihoku, Heitin, Kagi.

Laccifer greeni Chamb.

Tachardia greeni, Chamberlin, Bull. Ent. Res., xiv, p. 168 (1923).

Laccifer greeni, Cockerell, Psyche, xxxi, p. 47 (1924); Chamberlin, Bull. Ent. Res., xvi, p. 35 (1925); Takahashi, Trans. Nat. Hist. Soc. Formosa, xviii, p. 261 (1928).

Tachardia fici, Morrison, Philippine Jl. Sc., xvii, p. 178 (1920).

Hosts.—*Averrhoa carambola* (Geraniaceae), *Calliandra haematocephala* (Leguminosae), *Euphoria longana* (Sapindaceae), *Ficus wightiana* (Urticaceae), *Heritiera littoralis* (Sterculiaceae), *Liquidambar formosana* (Hamamelideae), *Machilus* sp. (Laurineae), *Mangifera indica* (Anacardiaceae), *Palaquium formo-*

sanum (Sapotaceae), *Platanus orientalis* (Platanaceae), *Rhodomyrtus tomentosa* (Myrtaceae).

Hab.—Kagi, Kurarn.

Common at Kagi, often being protected with shelters by *Cremastogaster rogenhoferi*.

Laccifer sp.

Tachardia sp., Chamberlin, Bull. Ent. Res., xiv, p. 173 (1923).

Laccifer sp., Chamberlin, Bull. Ent. Res., xvi, p. 39 (1925); Takahashi, Philippine Jl. Sc., xxxvi, p. 347 (1928).

Host.—*Citrus* sp. (Rutaceae).

Hab.—Heito.

Subfamily Diaspinae.

Aulacaspis rosae Bouche.

Fernald, Cat. Cocc. World, p. 236 (1903); Herrick, Missi. Agr. Expt. St., Tech. Bull. 2, p. 23 (1911); Dietz and Morrison, Cocc. Indiana, p. 284 (1916); Leonardi, Mon. Coce. Ital., p. 207 (1920); Ferris, Bull. Ent. Res., xii, p. 213 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 4, p. 22 (1926); Myers, Bull. Ent. Res., xvii, p. 341 (1927).

Diaspis rosae, Maki, Forest Expt. St. Formosa, Spec. Rept. I, p. 28 (1915); Green, Rec. Ind. Mus., xvi, p. 434 (1919).

Host.—*Rosa* sp. (Rosaceae).

Hab.—Taihoku.

Aulacaspis yabunikkei Kuw.

Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull., 4, p. 32 (1926).

Parlatoria cingala?, Shiraki, (nec. Green), Agr. Expt. St. Formosa, Spec. Rept. 8, p. 97 (1913).

Parlatoria cingala, Maki (nec. Green), Forest Expt. St. Formosa, Spec. Rept. 1, p. 26 (1915).

Aulacaspis cinnamomi, Ferris (nec. Newstead), Bull. Ent. Res., xii, p. 212 (1921).

Host.—*Cinnamomum camphora* (Laurineae).

Hab.—Taihoku, Hokuto, Shinten, Takeyama, Kagi.

Very common throughout the year, sometimes occurring in sufficient numbers entirely to cover the bark and is usually responsible for the death of the branches. A heavy infestation of this species is comparable to that of *Diaspis pentagona* Targ. to mulberry in Japan.

Aulacaspis mangiferae Newstead.

Diaspis (*Aulacaspis*) *cinnamomi* var. *mangiferae*, Newstead, Bull. Ent. Res., ii, p. 86 (1911).

Diaspis cinnamomi-mangiferae, Green, Rec. Ind. Mus., xvi, p. 433 (1919).

Hosts.—*Mangifera indica* (Anacardiaceae), *Machilus* sp. (Laurineae).

Hab.—Tainan, Hokuto, Shinten, Shirin.

New to the fauna of Formosa. Some specimens on *Machilus* sp. have been kindly examined by Mr. E. E. Green.

Aulacaspis tegalensis Zehntn.

Fernald, Cat. Cocc. World, p. 226 (1903); Ferris, Bull. Ent. Res., xii, p. 213 (1921).

Host.—*Saccharum officinarum* (Gramineae).

Hab.—Taihoku.

I have not collected this species.

Aulacaspis wakayamensis Kuw.

Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull., 4, p. 33 (1926).

Hosts.—*Miscanthus sinensis* (Gramineae), *Miscanthus* sp.

Hab.—Taihoku, Byoritsu, Gaishatei, Takeyama, Kanshirei, Funkiko, Shinten, Botel Tobago.

Very close to Kuwana's description, differing only in having fewer gland spines. Hitherto unrecorded from Formosa. Very common on *Miscanthus*, but not found on sugar cane.

Diaspis major Ckll.

Fernald, Cat. Cocc. World, p. 220 (1903); Morrison, Proc. Ent. Soc. Washington, xxvi, p. 232 (1924).

Aulacaspis flacourtiae, Rutherford, Bull. Ent. Res., v, p. 259 (1914).

Diaspis (*Aulacaspis*) *flacourtiae*, Green and Laing, Bull. Ent. Res., xii, p.

128 (1921).

Host.—*Scolopia crenata* (Bixineae).

Hab.—Sankyaku near Taihoku, Taihoku, Suisha.

Some specimens have been examined by Mr. E. E. Green.

Diaspis pentagona Targ.

Aulacaspis pentagona, Fernald, Cat. Cocc. World, p. 234 (1903); Herrick, Missi. Agr. Ext. St., Tech. Bull. 2, p. 22 (1911); Ferris, Bull. Ent. Res., xii, p. 213 (1921).

Diaspis pentagona, Shiraki, Agr. Expt. St. Formosa, Spec. Rept., 8, p. 93 (1913).

Pseudaulacaspis pentagona, MacGillivray, Cocc., p. 315 (1921).

Sasakiaspis pentagona, Kuwana, Dept. Finance, Imp. Plant Quar. Serv. Tech. Bull., 4, p. 9 (1926).

Hosts.—*Morus alba* (Urticaceae), *Prunus communis* (Rosaceae), *P. persica*, *P. pogonostyla*, *P.* sp.

Hab.—Taihoku, Toyen, Shinten, Karenko, Tamio, Hozan, Kagi, Kanshirei, Hassenzan.

Abundant on *Prunus* spp., but rarely so on mulberry in Formosa.

Phenacaspis eugeniae Mask.

Fernald, Cat. Cocc. World, p. 238 (1903); Ferris, Bull. Ent. Res., xii, p. 213 (1921).

Hosts.—Michelia alba (Magnoliaceae), M. fuscata.

Hab.—Taihoku.

Chionaspis vitis Green.

Fernald, Cat. Cocc. World, p. 226 (1903); Kuwana, Minist. Agr. Forest., Dept. Agr., Sc. Bull. 1, p. 28 (1928).

Hosts.—*Acalypha kotoensis* (Euphorbiaceae), *Elaeagnus glabra* (Elaeagnaceae), *E. kotoensis*, *E. thunbergii*, *Kandelia rheedii* (Rhizophoreae), *Mallotus philippensis* (Euphorbiaceae).

Hab.—Taihoku, Tansui, Maruyama, Komoko, Botel Tobago.

Hitherto unrecorded from Formosa and Botel Tobago. Very abundant on *Elaeagnus kotoensis* in Botel Tobago. Some specimens have been examined by Mr. E. E. Green.

Chionaspis stanotophri Cooley.

Fernald, Cat. Cocc. World, p. 226 (1903); Brain, Bull. Ent. Res., ix, p. 233 (1918-19); Hall, Bull. Soc. Ent. Egypt., 1926, p. 166 (1927).

Host.—A plant of the Gramineae.

Hab.—Taito.

Hitherto unrecorded from Formosa. The Formosan specimens have been kindly identified by Mr. E. E. Green.

Chionaspis graminis Green var. **divergens** Green.

Cocc. Ceylon, ii, p. 123 (1899).

Hosts.—*Spinifex littoreus* (Gramineae), a plant of the Gramineae.

Hab.—Tansui, Taihoku.

Hitherto unrecorded from Formosa. The typical *graminis* Green has not been collected in Formosa. Very common on *Spinifex littoreus* near the beach at Tansui.

Chionaspis elongata Green.

Fernald, Cat. Cocc. World, p. 216 (1903).

Host.—*Bambusa* sp.

Hab.—Taihoku, Itahashi, Shinten, Hokuto, Toyen, Maruyama.

New to the fauna of Formosa. Very common.

Pinnaspis aspidistrae Signt.

Hemichionaspis aspidistrae, Fernald, Cat. Cocc. World, p. 239 (1903); Herrick, Missi. Agr. Expt. St., Tech. Bull. 2, p. 39 (1911); Dietz and Morrison, Cocc. Indiana, p. 274 (1916); Leonardi, Mon. Cocc. Ital., p. 222 (1920).

Chionaspis aspidistrae, Maki, Forest Expt. St. Formosa, Spec. Rept. 1, p. 28 (1915).

Chionaspis (*Pinnaspis*) *aspidistrae*, Brain, Bull. Ent. Res., x, p. 104 (1919).

Pinnaspis aspidistrae, Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 4, p. 36 (1926).

Hosts.—*Aspidistra lurida* (Liliaceae), *Asplenium nidus* (Polypodiaceae), *Eurya japonica* (Terrstroemiaceae), an orchid.

Hab.—Taihoku, Shinten.

Pinnaspis minor Mask.

Hemichionaspis minor, Fernald, Cat. Cocc. World, p. 240 (1903).

Pinnaspis minor, Ferris, Bull. Ent. Res., xii, p. 214 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 4, p. 38 (1926).

Host.—Unknown in Formosa.

Hab.—Taihoku.

I have not collected this species in Formosa.

Pinnaspis theae Mask.

Hemichionaspis theae, Fernald, Cat. Cocc. World, p. 241 (1903).

Chionaspis theae, Shiraki, Agr. Expt. St. Formosa, Spec. Rept. 8, p. 96 (1913).

Hosts.—*Thea chinensis* (Ternstroemiaceae), *T. japonica*.

Hab.—Kanshirei, Koshun.

Pinnaspis uniloba Kuw.

Mytilaspis (*Lepidosaphes*) *uniloba*, Kuwana, Jl. N. Y. Ent. Soc., xvii, p. 156 (1909).

Lepidosaphes uniloba, Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Bull. 2, p. 37 (1925).

Pinnaspis simplex, Ferris, Bull. Ent. Ret., xii, p. 214 (1921).

Hosts.—*Cleyera ochnacea* (Ternstroemiaceae), *Eurya japonica* (Ternstroemiaceae), *Osmanthus fragrans* (Oleaceae), *Thea japonica* (Ternstroemiaceae).

Hab.—Taihoku, Shinten, Hokuto, Sekitei, Hori, Kanshirei, Karapin.

Very common, but hitherto unrecorded from Formosa.

Pygalataspis miscanthi Ferris.

Bull. Ent. Res., xii, p. 218 (1921).

Host.—*Miscanthus sinensis* (Gramineae), attacking the basal part of the upper surface of the leaf.

Hab.—Taihoku, Shinten.

Lepidosaphes cymbidicola Kuw.

Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull, 2, p. 27 (1925).

Hosts.—*Cycas revoluta* (Cycadaceae), an orchid (Orchideae).

Hab.—Taihoku, Shinka.

Lepidosaphes becki Newm.

Fernald, Cat. Cocc. World, p. 305 (1903); Ferris, Bull. Ent. Res., xii, p. 216 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 2, p. 14 (1925).

Lepidosaphes citricolo, Shiraki, Agr. Expt. St. Formosa, Spec. Rept. 8, p. 100 (1913).

Hosts.—*Citrus* spp. (Rutaceae), *Murraya exotica* (Rutaceae).

Hab.—Taihoku, Keelung, Heito, Giran, Shinka.

Lepidosaphes gloveri Pack.

Fernald, Cat. Cocc. World, p. 309 (1903); Shiraki, Agr. Expt. St. Formosa, Spec. Rept., 8, p. 99 (1913); Kuwana, Dept. Finance, Plant Quar. Serv., Tech. Bull. 2, p. 16 (1925).

Hosts.—*Carissa carandas* (Passiflorae), *Citrus* spp. (Rutaceae).

Hab.—Taihoku, Shirin, Giran, Shimpe, Mato, Hozan, Heito, Taito.

Lepidosaphes pallida Green.

Fernald, Cat. Cocc. World, p. 312 (1903); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 2, p. 9 (1925).

Mytilaspis pallida, Green, Bull. Ent. Res., v, p. 233 (1914).

Host.—*Kandelia rheedii* (Rhizophoreae).

Hab.—Komoko.

Lepidosaphes tubulorum Ferris.

Bull. Ent. Res., xii, p. 216 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 2, p. 30 (1925).

Hosts.—*Erythrina* sp. (Leguminosae), *Salix warburgii* (Salicineae), *Sapium sebiferum* (Euphorbiaceae), a plant of the Leguminosae.

Hab.—Taihoku, Hokuto, Taichu, Kagi, Karenko.

Very plentiful, occurring in enormous numbers and occasionally killing the young hosts in Formosa.

Lepidosaphes kamakurensis Kuw.

Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 2, p. 18 (1925).

Hosts.—*Ardisia* sp. (Myrsineae), *Heptapleurum octophyllum* (Araliaceae),

Heterosmilax japonica (Liliaceae).

Hab.—Taihoku, Shirin, Kagi.

New to the fauna of Formosa.

Fiorinia juniperi Leon.

Redia, iii, 1, p. 39 (1906); Ferris, Bull. Ent. Res., xii, p. 215 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 3, p. 8 (1925).

Hosts.—*Podocarpus macrophylla* (Coniferae).

Hab.—Taihoku, Tansui.

Hitherto unrecorded from Formosa.

Fiorinia japonica Kuw.

Fiorinia fioriniae japonica, Fernald, Cat. Cocc. World, p. 247 (1903).

Fiorinia japonica, Ferris, Bull. Ent. Res., xii, p. 215 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 3, p. 5 (1925).

Hosts.—*Pinus thunbergii* (Coniferae), *Keteleeria davidiana* (Coniferae).

Hab.—Taihoku, Maruyama.

Fiorinia theae Green.

Fernald, Cat. Cocc. World, p. 250 (1903); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 3, p. 10 (1925).

Hosts.—*Citrus* spp. (Rutaceae).

Hab.—Taihoku, Heito, Hozan, Mato, Kagi.

This species is not rare on *Citrus* in the southern part of Formosa, but is very scarce on it near Taihoku. The specimens recorded under the name of *Chionaspis flava* Green by Shiraki (Agr. Expt. St. Formosa, Spec. Rept. 8, p. 95) are not *C. flava* Green, but are apparently *Fiorinia theae* Green.

Fiorinia fioriniae Targ.

Fernald, Cat. Cocc. World, p. 246 (1903); Brain, Bull. Ent. Res., ix, p. 221 (1918-19); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 3, p. 3 (1925).

Hosts.—*Eucalyptus* sp. (Myrtaceae), *Machilus kusanoi* (Laurineae), *Thea japonica* (Ternstroemiaceae).

Hab.—Taihoku, Kagi.

Fiorinia chinensis Ferris.

Bull. Ent. Res., xii, p. 216 (1921).

Hosts.—*Celtis sinensis* (Urticaceae), *Ficus pumila* (Urticaceae).

Hab.—Taihoku.

Very common, but hitherto unrecorded from Formosa. The hosts of this species are previously unknown.

Fiorinia saprosmae Green.

Fernald, Cat. Cocc. World, p. 249 (1903).

Host.—*Ficus sp.* (Urticaceae).

Hab.—Botel Tobago.

Hitherto unrecorded from Botel Tobago and not found in Formosa. Some specimens have been kindly examined by Mr. E. E. Green.

Fiorinia nephelii Mask.

Fernald, Cat. Cocc. World, p. 248 (1903).

Hosts.—*Euphoria longana* (Sapindaceae), *Nephelium litchi* (Sapindaceae).

Hab.—Maruyama, Kagi, Hori, Shoka.

Very common, but the hosts suffer slightly.

Parlatoria pergandei Comst.

Fernald, Cat. Cocc. World, p. 319 (1903); Ferris, Bull. Ent. Res., xii, p. 214 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 1, p. 7 (1925).

Hosts.—*Citrus* spp. (Rutaceae), *Cymbidium sinense* (Orchideae), *Osmanthus fragrans* (Oleaceae), *Thea japonica* (Ternstroemiaceae).

Hab.—Taihoku, Taichu, Hokuto.

No case of serious damage has been observed.

Parlatoria zizyphi Lucas.

Fernald, Cat. Cocc. World, p. 322 (1903); Shiraki, Agr. Expt. St. Formosa, Spec. Rept. 8, p. 97 (1913); Maki, Forest Expt. St. Formosa, Spec. Rept., 1, p. 26 (1915); Ferris, Bull. Ent. Res., xii, p. 214 (1921); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 1, p. 6 (1925).

Hosts.—*Citrus* spp. (Rutaceae).

Hab.—Taihoku, Shirin, Urai, Giran, Takeyama, Kagi, Mato, Heito, Choshu.

Maskell recorded this species from *Psidium* in Formosa, but I have not collected it on this plant.

Parlatoria proteus Curtis.

Fernald, Cat. Cocc. World, p. 220 (1903); Kuwana, Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. 1, p. 10 (1925).

Hosts.—*Citrus* spp. (Rutaceae), *Cymbidium sinense* (Orchideae), *Monstera deliciosa* (Araliaceae)

Hab.—Taihoku.

Parlatoria crotonis Dougl.

Fernald, Cat. Cocc. World, p. 319 (1903).

Hosts.—*Acer* sp.? (Sapindaceae), *Dendrobium moschatum* (Orchideae).

Hab.—Taihoku, Sozan.

Hitherto unrecorded from Formosa. Kindly identified by Mr. E. E. Green.

Odonaspis penicillata Green.

Jl. Bombay Nat. Hist. Soc., xvi, p. 346 (1905); Ferris, Bull. Ent. Res., xii, p. 219 (1921).

Hosts.—*Bambusa stenostachya* (Gramineae), *B.* sp., *Dendrocalamus latiflorus* (Gramineae).

Hab.—Taihoku, Maruyama.

Odonaspis secreta Ckll.

Fernald, Cat. Cocc. World, p. 300 (1903).

Host.—*Bambusa stenostachya* (Gramineae).

Hab.—Taihoku.

Hitherto unrecorded from Formosa. A few specimens were collected by me in March 1928. In these specimens the groups of circumgenital glands are connected above by a single row of the glands.

Pseudaonidia trilobitiformis Green.

Fernald, Cat. Cocc. World, p. 284 (1903); Brain, Bull. Ent. Res., ix, p. 209 (1918-19); Ferris, Bull. Ent. Res., xii, p. 220 (1921).

Aspidiotus trilobitiformis Green, Jl. Bombay Nat. Hist. Soc., xiii, p. 66

(1902); Kuwana, Illust. Mon. Cocc. Japan, i, p. 67 (1911).

Hosts.—*Artocarpus integrifolia* (Urticaceae), *Calophyllum inophyllum* (Guttiferae), *Citrus* sp. (Rutaceae), *Ficus elastica* (Urticaceae), *F. retusa*, *F.* sp., *Machilus* sp. (Laurineae), *Murraya exotica* (Rutaceae), *Thea japonica* (Ternstroemiaceae).

Hab.—Taihoku, Keelung, Kagi, Kurarn, Botel Tobago.

Pseudaonidia duplex Ckll.

Fernald, Cat. Cocc. World, p. 283 (1903); Kuwana, Illust. Mon. Cocc. Japan, i, p. 69 (1911); Ferris, Bull. Ent. Res., xii, p. 220 (1921).

Host.—*Michelia fuscata* (Magnoliaceae).

Hab.—Taihoku.

Very scarce in Formosa, having not been collected by me.

Aspidiotus excisus Green.

Fernald, Cat. Cocc. World, p. 258 (1903).

Hosts.—*Clerodendron inerme* (Verbenaceae), attacking the upper side of the leaf along the middle rib, *Elephantopus mollis* (Compositae).

Hab.—Taihoku, Washoshu, Shinten, Bozan, Koshun.

Hitherto unrecorded from Formosa. My specimens have been kindly examined by Mr. E. E. Green.

The females on *Clerodendron inerme* are concealed in gall-like folds on the leaves.

Aspidiotus cyanophylli Signt.

Fernald, Cat. Cocc. World, p. 255 (1903).

Host.—*Thea chinensis* (Ternstroemiaceae), attacking the lower side of the leaf.

Hab.—Suisha.

Hitherto unrecorded from Formosa. A few specimens were collected by me in September 1928.

Aspidiotus destructor Signt.

Fernald, Cat. Cocc. World, p. 257 (1903).

Hosts.—*Carica papaya* (Passiflorae), attacking the leaf; *Ficus* sp. (Urticaceae), *Pandanus boninensis* (Pandaneae), *Trachycarpus excelsus* (Palmae).

Hab.—Taihoku, Botel Tobago.

In the specimens collected on *Trachycarpus excelsus*, the median lobes are stouter than, but almost as long as, the 2nd lobes, while the former are as large as the latter in the specimens on *Carica papaya*. In the females on *Pandanus boninensis*, the median lobes are as long as, but somewhat more slender than, the 2nd. *Aspidiotus transparens* Green seems to be identical with this species.

Aspidiotus implicatus Mask.

Fernald, Cat. Cocc. World, p. 265 (1903)

Host.—*Campanula* ? (Maskell).

Hab.—?

I have not collected this species.

Aspidiotus lataniae Signt.

Fernald, Cat. Cocc. World, p. 266 (1903); Herrick, Missi. Agr. Expt. St., Tech. Bull., 2, p. 18 (1911); Dietz and Morrison, Cocc. Indiana, p. 299 (1916); Ferris, Bull. Ent. Res., xii, p. 219 (1921).

Aspidiotus cydoniae, Comstock, Cornell Univ. Agr. Expt. St., Bull. 372, p. 444 (1916).

Aspidiotus (*Hemiberlesea*) *lataniae*, Brain, Bull. Ent. Res., ix, p. 129 (1918).

Hosts.—*Cocos nucifera* (Palmae), *Cycas revoluta* (Cycadaceae), *Cymbidium sinense* (Orchideae), *Hibiscus rosa-sinensis* (Malvaceae), *Morus alba* (Urticaceae).

Hab.—Taihoku, Maruyama, Karenko.

Kuwana's *Aspidiotus lataniae* (Illust. Mon. Cocc. Japan. i, p. 85, 1911) is not true *lataniae* Signt., but seems to be *A. destructor* Signt.

Chrysomphalus aurantii Mask.

Fernald, Cat. Cocc. World, p. 287 (1903); Herrick, Missi. Agr. Expt. St., Tech. Bull. 2, p. 30 (1911); Dietz and Morrison, Cocc. Indiana, p. 307 (1916) Leonardi, Mon. Cocc. Ital., p. 75 (1920); Ferris, Bull. Ent. Res., xii, p. 219 (1921).

Hosts.—*Ardisia* sp. (Myrsineae), *Citrus* spp. (Rutaceae), *Heptapleurum octophyllum* (Araliaceae).

Hab.—Taihoku, Kagi, Mato, Hozan.

This species is common on *Citrus*, occasionally occurring in enormous

numbers, but is much fewer than *C. aonidum* L.

Chrysomphalus aonidum L.

Fernald, Cat. Cocc. World, p. 286 (1903); Herrick, Missi. Agr. Expt. St., Tech. Bull. 2, p. 29 (1911); Dietz and Morrison, Cocc. Indiana, p. 312 (1916); Ferris, Bull. Ent. Res., xii, p. 220 (1921); Myers, Bull. Ent. Res., xvii, p. 345 (1927).

Aspidiotus ficus, Shiraki, Agr. Expt. St. Formosa, Spec. Rept., 8, p. 93 (1913).

Hosts.—*Areca catechu* (Palmae), *Artabotrys odoratissimus* (Anonaceae), *Buxus japonicus* (Euphorbiaceae), *Calophyllum inophyllum* (Guttiferae), *Carissa carandas* (Passiflorae), *Cinnamomum camphora* (Laurineae), *Citrus* spp. (Rutaceae), *Cleyera ochnacea* (Ternstroemiaceae), *Cocos nucifera* (Palmae), *Cycas revoluta* (Cycadaceae), *Evodia roxburghiana* (Rutaceae), *Ficus retusa* (Urticaceae), *Garcinia spicata* (Guttiferae), *Ligustrum japonicum* (Oleaceae), *Machilus* sp. (Laurineae), *Mahonia japonica* (Berberideae), *Musa sapientum* (Scitamineae), *Myristica heterophylla* (Myristiceae), *Osmanthus fragrans* (Oleaceae), *Palaquium formosanum* (Sapotaceae), *Pandanus odoratissimus* (Pandaneae), *Pinus* sp. (Coniferae), *Podocarpus macrophylla* (Coniferae), *Rosa* sp. (Rosaceae), *Thea chinensis* (Ternstroemiaceae), *T. japonica*, *Thevetia* sp. (Apocynaceae).

Hab.—Taihoku, Shirin, Itahashi, Shinten, Heitin, Kagi, Tamio, Tainan, Shinka, Heito, Yensuiko, Taito, Koshun, Giran, Rato, Takeyama, Hori, Nisui.

I observed numerous individuals of this species on the leaves of *Pinus* sp. and *Podocarpus macrophylla* at Hori and Nisui in September 1928. These specimens can not be separated morphologically from those on *Citrus*. This species is parasitized by* *Aphelinus chrysomphali* Mercet and *Coccophagous hawaiiensis* Tim., but is by far the most abundant member of the entire species of the family on *Citrus* and among the major pests of it in Formosa.

Chrysomphalus rossi Mask.

Fernald, Cat. Cocc. World, p. 293 (1903); Brain, Bull. Ent. Res., ix, p. 202 (1918-19).

Hosts.—*Bryophyllum calycinum* (Crassulaceae), *Calophyllum inophyllum* (Guttiferae), *Kandelia rheedii* (Rhizophoreae), *Mangifera indica* (Anacardiaceae).

* Identified by Dr. Timberlake; very common near Taihoku.

Hab.—Taihoku, Shoka, Gyochi, Komoko.

Hitherto unrecorded from Formosa.

Chrysomphalus dictyospermi Morg.

Fernald, Cat. Cocc. World, p. 289 (1903).

Hosts.—*Citrus* spp. (Rutaceae), *Cycas revoluta* (Cycadaceae).

Hab.—Taihoku, Heito.

New to Formosa. The specimens on *Citrus* have been kindly examined by Dr. H. Morrison.

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